



National Institutes of Health

*Draft Environmental
Impact Statement
Master Plan
2003 Update*

Main Campus - Bethesda, Maryland
September 2004

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

for

NIH Master Plan 2003 Update
National Institutes of Health
Main Campus
Bethesda, Maryland

September 2004

Prepared by:

U.S. Department of Health and Human Services
National Institutes of Health

Office of Research Facilities Development and Operations
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Submitted Pursuant to 42 U.S.C. 4332(2)(C)

I concur that this document is acceptable for public availability.

----- Signed by Leonard Taylor -----

Leonard Taylor, Jr.
Acting Director, Office of Research Facilities
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9/22/04

Date

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Section One

Summary

1.1 ADMINISTRATIVE ACTION

This is a Draft Environmental Impact Statement (DEIS) for the Master Plan 2003 Update for the National Institutes of Health (NIH) campus in Bethesda, Maryland.

1.2 INDIVIDUAL WHO MAY BE CONTACTED

The following individual may be contacted for additional information concerning the proposed action, this Draft Environmental Impact Statement and other documentation.

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Written comments about the Draft Master Plan and this Environmental Impact Statement may be sent to the above individual. Comments will be received until November 29, 2004.

1.3 ADDITIONAL REPORTS

The following documents are an integral part of the environmental documentation for the NIH Bethesda campus Master Plan and are incorporated into this Environmental Impact Statement Supplement by reference:

Draft NIH Master Plan 2003 Update, the National Institutes of Health Main Campus, Bethesda, Maryland, NIH, 2004

Master Utility Plan: 2000 Update (UMUP), Mueller Associates II, Inc. and TA Engineering, Inc., 2000

Amendment to the 1995 Master Plan, NIH Main Campus, Bethesda, Maryland, NIH, 1999.

Final Supplemental Environmental Impact Statement, Proposed Revisions to Northwest Sector of the 1995 Master Plan, NIH, 1999

NIH Bethesda Campus Historic Resources Survey and National Register Determination of Eligibility, NIH, 1997

1995 Master Plan, the National Institutes of Health, Main Campus, Bethesda, Maryland, NIH, 1995

Final Environmental Impact Statement for the 1995 Master Plan, National Institutes of Health Main Campus, Bethesda, Maryland, NIH, 1996

NIH Central Infrastructure Utility System, Task 4.0, Master Utility Plan, Ross Murphy Finkelstein, 1992
Utility System Analysis and Planning, Task 3.0 Report, Ross Murphy Finkelstein, 1994

Master Plan Transportation Report for National Institutes of Health, Main Campus, Bethesda, Maryland, Grove/Slade Associates, Inc., 2004

1.4 EXISTING CONDITIONS SUMMARY

The primary mission of the National Institutes of Health (NIH) is to expand fundamental knowledge about the nature and behavior of living systems, to apply that knowledge to extend the health of human lives, and to reduce the burdens of disease and disability. The primary activity at NIH Bethesda is biomedical and clinical research, and it is the largest such facility in the world. About ten percent of all NIH research is conducted directly on the campus through the NIH intramural research program. Individuals and institutions outside NIH complete the remainder under the NIH extramural research grant and contract program, which is directed and coordinated through the NIH Office of the Director.

The NIH Bethesda campus is a 310-acre federal facility located in Montgomery County, Maryland, in suburban Washington, D.C. (See Appendix A for site mapping). About 17,500 NIH employees work on the campus in over 75 buildings with a cumulative occupiable gross floor area of nearly 7.4 million gross square feet (gsf) exclusive of parking. The Office of the Director of NIH and headquarters administration is located on the campus along with the administrative staff of 27 individual and independent research Institutes and Centers, (ICs), such as the National Cancer Institute and the National Heart, Lung, and Blood Institute, that comprise NIH.

All but one of the ICs maintains research facilities on the campus. About one-fourth of the campus employees are Ph.Ds, M.Ds, or hold both degrees, and are involved in clinical and basic biomedical research. Most of the remaining facilities and personnel on the campus provide very specialized support for the research function. Examples include training researchers and monitoring laboratory safety; handling and treatment of biological, chemical, and radioactive materials; laboratory animal care through the veterinary program; manufacture and maintenance of specialized research equipment; and computer services.

The focal facility on the campus is the Warren G. Magnuson Clinical Center. The Clinical Center is the largest facility in the U.S. devoted exclusively to biomedical clinical research. Clinical research consists of clinical trials where new techniques, medicines, treatments, and basic laboratory research findings are tested on volunteer patients. In 2002, over 7,500 volunteers participated in clinical trials as long term inpatients, and outpatients made over 74,000 trips to the campus involved in clinical trials lasting a day or less.

The original section of the Clinical Center, Building 10, was built in 1953. Over the years, many additions and wings have been built in response to the growing mandated research mission of NIH. Many of the Institute research buildings were built prior to 1955. Design and layout of these older buildings did not foresee the explosion in use of electronic laboratory equipment. The variety of biological, radiological, and chemical materials used in research has increased exponentially. Progress in research has increased the number of devices and equipment now considered essential for modern patient care.

In 1994, at the request of the U.S. Congress, an External Advisory Committee (EAC) undertook a thorough review of the role, size, organization, and cost of the NIH intramural research program. The EAC concluded that a smaller scale clinical center hospital could replace the Magnuson hospital, and existing hospital patient spaces could be modified to clinical or general research facilities.

The Mark Hatfield Clinical Research Center (CRC), which will replace the Magnuson hospital, is under construction with occupancy scheduled for 2004. Once the 240 bed CRC facility is complete, the remaining Magnuson Clinical Center and Building 10 facilities will undergo renovation after stabilization of building mechanical, electrical, and utility systems.

The Bethesda campus is currently in the midst of perhaps its most rapid transformation in its history. The Vaccine Research Center (VRC) (Building 40), the Louis Stokes Laboratory (Building 50), and the East Child Care Center (Building 64) all went into service in 2001. A new fire station (Building 51) and NIH electric power substation (Building 63) were built in 2003. Projects that are in various stages of design or construction and scheduled for occupancy in 2004 include a Family Lodge, expansion of the Children's Inn, Phase I of the Neuroscience Research Center, and a NIH/PEPCO Cogeneration facility, and two multiple level parking structures ,MLP-9 and MLP-10. Building 33, a research facility is also under construction and scheduled for service in 2005.

The events of September 2001 have brought about further changes that are in progress. Prior to that time, the campus was fully accessible to the general public. In the interim, a perimeter fence providing security has been built, and vehicles are checked or inspected at the portal entrances. A new Gateway Center for visitor screening, and accompanying garage, and a commercial vehicle inspection facility, are now in the design stage and expected to open in 2005.

1.5 ALTERNATIVES UNDER CONSIDERATION

Two alternatives are under consideration: The Master Plan 2003 Update Alternative (also identified as the Master Plan or Master Plan Alternative), and the No Action Alternative. The Alternatives are discussed in Section 4. The Master Plan 2003 Alternative is a revision of the 1995 Master Plan for the Bethesda campus. The 1995 Master Plan and its 2003 Update have been developed using procedures in the National Environmental Policy Act (42 U.S.C. 4332 (2)(A)) and the Council on Environmental Quality regulations (40 C.F.R §1500 et. seq.). Government review agencies, utilities, NIH management and employees, residential neighborhood representatives, citizens, and interested parties were involved in the decision making process through a series of scoping and information meetings and a public hearing. Revisions to the Master Plan have been developed in consultation with community working groups, which were open to representatives from residential communities and civic organizations near the campus.

Normally, the No Action Alternative can be defined as no net growth or change in employee numbers or facilities in relation to baseline or existing conditions. Facilities would be replaced or rehabilitated as necessary to maintain site functions. However, NIH is already "committed" to a number of projects that will be implemented in both the Master Plan and No Action Alternatives. A number of buildings are in various stages of planning, design and construction, and can be expected to go forward to fruition. These projects are included in the No Action Alternative and are itemized in Table 4-3.

Under the No Action Alternative, the total building floor space would increase from about 7.4 million gsf to about 8.9 million gsf in 2007. The estimated No Action Alternative employee population would be about 17,900. About two-thirds of the space increase is attributable to the Hatfield Clinical Research Center. About two-thirds of the population increase is attributable to Research Building 33. The Neuroscience Research Center and Hatfield Clinical Research Center projects would primarily involve internal campus transfer of employees, and not new hires.

The Master Plan 2003 Update Alternative is the preferred alternative.

1.6 PROPOSED ACTION – THE MASTER PLAN 2003 UPDATE

The proposed action is the Master Plan 2003 Update of the 1995 Bethesda campus Master Plan. It would guide and coordinate physical development of the NIH Bethesda campus in terms of buildings, utilities, roads and streetscape, landscapes, and amenities over the next 20 years in response to projected NIH

administrative, research, and infrastructure support needs (Draft Master Plan 2003 Update, NIH Main Campus, NIH, 2004). NIH may deviate from the plan to satisfy ongoing exigencies. The Master Plan does not commit NIH to implementing specific projects indicated or illustrated in the plan. Implementation of any feature or project in the Master Plan is dependent on Congressional funding.

The Bethesda campus employee population was 16,350 in 1995. At that time, the federal government was making major efforts to “downsize” and reduce the number of employees. Consequently, the 1995 Master Plan projected a short term decline in the number of campus employees through 2000. A generally linear increase after that date to about 18,000 in 2015 was projected. However, beginning in 1998, the NIH annual research budget began to increase at a faster rate than that experienced over the preceding decades, a change unanticipated in 1995. Some of the increase is attributable to the rapid definition of the human genome, a task that was originally expected to take decades. As a result, the campus population has already increased to about 17,500 in 2003.

Programming of future campus personnel and facilities was determined through an extensive series of interviews with NIH management and individual Institute and Center directorates. Many Institutes anticipate continued rapid expansion of research into new areas as a result of the human genome definition. Their projections were combined into an overall estimate of potential population for the NIH Bethesda campus. Cumulatively, the projections indicate that the campus intramural researcher population would grow from about 8,500 in 2000 to about 14,500 in 2020. If unconstrained by traffic congestion, utility system capacities, or consideration of the surrounding community, this increase in personnel directly involved with research, along with personnel involved in essential support, would increase the campus population to about 26,000.

Adding personnel beyond a level of about 22,000 to the campus becomes increasingly complex within site physical constraints, and planning principles and goals. As a basis for planning, the Master Plan 2003 Update, therefore, has set a campus population of 22,000 as a reasonable number of personnel that can be accommodated within these constraints, and the Master Plan’s own principles, and goals.

Proposed facilities and planning criteria are detailed within the Master Plan document, and are summarized in Section 4.7.1 of this Draft EIS.

The principal features of the Master Plan are:

- Construction of the state-of-the-art Hatfield Clinical Research Center hospital with associated clinical research laboratories. The 1,050,000 gross square foot (gsf) facility will replace the existing Clinical Center inpatient hospital with 240 inpatient beds and 90 day-hospital stations.
- Stabilization of nearly half a million gsf of space in the existing Magnusen Clinical Center Complex to prepare it for adaptive reuse.
- Construction of up to 12 new buildings for intramural research. The new buildings would add a net of about 2.17 million gsf of laboratory space.
- A continuation of the upgrading and modernization program for support utilities and infrastructure, particularly the Central Heating and Refrigeration Plant, campus steam, chilled water, and electric power distribution systems.
- Replacement of housing and care facilities for animals used in research with state-of-the-art facilities that satisfy modern design, accreditation, and program requirements.
- Consolidation of surface parking into multiple level and underground parking structures.
- Construction of a Loop Road that follows existing campus streets to improve campus vehicle circulation and emphasize pedestrian and bicycle use in the central core area of the campus.
- A physical reorganization of the campus to improve administrative and operational functions, raise the aesthetic level or ambience, and protect older campus buildings of historic value.

- Management of stormwater through a site Institutional Stormwater Management Plan that will meet Maryland standards throughout the campus.
- Construction of expanded child care facilities for employees, small scale retail and service activities, and other employee amenities.
- Enhancement of a natural area or buffer zone around the periphery of the campus through removal of surface parking and increased landscaping. The zone would buffer residential neighborhoods surrounding the campus from NIH facilities and activities. .

1.7 SUMMARY OF IMPACTS AND MITIGATION

The Master Plan is a long range planning guidance document, and it will not generate direct physical impacts such as those associated with construction. It must be flexible to meet changes in NIH needs and campus conditions. This EIS furnishes information, supplementary to the Master Plan, and identifies the potential impacts that could occur. While some impacts are determined for intermediate periods, the delineated Master Plan impacts are based on, or assume, full implementation of the Master Plan, i.e. building space would increase from 7.4 to 10.7 million gsf, campus population would grow from 17,500 to 22,000, and all plan elements and features would be implemented. The delineated impacts, therefore, indicate the potential cumulative effects of the Master Plan. They can be viewed as an impact framework or envelope within which the incremental impacts of individual projects would fall, if and when they are implemented. The delineated potential impacts are conditional or contingent upon the extent of any actual implementation. Actual cumulative impacts would fall in the range between those indicated for the No Action and the Master Plan Alternative. The potential impacts of the Master Plan and No Action Alternatives are summarized in Table 1-1 (See Page 1-6).

NIH is committed to the measures listed in Table 1-2 to mitigate the potential impact of the proposed Master Plan or No Action Alternatives.

1.8 APPROVALS/ACTIONS REQUIRED BY OTHER GOVERNMENT AGENCIES

Section 5(a) of the National Capital Planning Act of 1952, as amended (40 U.S.C. § 71d(a)), provides that each federal agency in the National Capital Region shall advise and consult with the National Capital Planning Commission (NCPC) in the preparation of plans and programs which affect the National Capital prior to preparation of construction plans. NCPC defines a master plan as an integrated series of documents in graphic, narrative, or tabular form that present a plan for the orderly and long range development of an installation, generally over a period of 20 years. NCPC maintains that a master plan approved by the Commission is a required preliminary stage for the preparation of building and site plans for specific projects. If the installation is in the Maryland portion of the National Capital Region, then the Maryland-National Capital Park and Planning Commission (M-NCPPC) acts in an advisory capacity to NCPC.

In accordance with Section 102(2)(A) of the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. § 4332(2)(A)), federal agencies must utilize a systematic, interdisciplinary approach which will ensure the integrated use of natural and social sciences in planning and decision making that may have an impact on the human environment. Regulations of the Council on Environmental Quality (CEQ) (40 C.F.R. Parts 1500-1508) require that agencies assess the environmental effects of their actions, document studies and identify impacts. Documents can take the form of Categorical Exclusions, Environmental Assessments, or Environmental Impact Statements, and their supporting documents (Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act,

CATEGORY	MASTER PLAN ALTERNATIVE POTENTIAL IMPACT	NO ACTION ALTERNATIVE POTENTIAL IMPACT
Socioeconomic/Land Use	<ul style="list-style-type: none"> No significant impact expected. 	<ul style="list-style-type: none"> No significant impact expected.
Environmental Justice	<ul style="list-style-type: none"> No disproportionate impact to minority or low-income populations. 	<ul style="list-style-type: none"> No disproportionate impact to minority or low-income populations.
NIH Traffic Generation	<ul style="list-style-type: none"> NIH AM and PM traffic generation increases by about 26%. Trip generation would be less than what NIH Bethesda generated in 1992. 	<ul style="list-style-type: none"> NIH AM and PM traffic generation increases by about 2%. Trip generation would be less than what NIH Bethesda generated in 1992.
Intersection Congestion	<ul style="list-style-type: none"> The number of intersections around the campus with Critical Lane Volumes (CLV) greater than 1,600 increases from one, currently, to eight in 2023. 	<ul style="list-style-type: none"> The number of intersections around the campus with Critical Lane Volumes (CLV) greater than 1,600 increases from one, currently, to eight in 2023.
Parking	<ul style="list-style-type: none"> Total spaces increase from 9,359 (employees and visitors) to 12,449. Maintain 0.50 employee space per employee ratio with goal of 0.45. Increase visitor spaces. 	<ul style="list-style-type: none"> Total spaces increase from 9,359 (employees and visitors) to 10,000. Maintain 0.50 employee space per employee ratio with goal of 0.45. Increase visitor spaces.
Buffer/Bikeways	<ul style="list-style-type: none"> Buffer zone landscaping is enhanced. Buffer parking surface is reduced from 6.8 to 0.6 acre. 	<ul style="list-style-type: none"> Limited buffer zone enhancement. Buffer parking that can be accommodated in MLP-9 and MLP-10 is eliminated. Buffer parking surface reduced to 3.1 acre
Steam Demand	<ul style="list-style-type: none"> Peak day demand increases from 585,000 to 968,000 lb/hr. 	<ul style="list-style-type: none"> Peak day demand increases from 585,000 to 776,000 lb/hr.
Chilled Water Demand	<ul style="list-style-type: none"> Peak demand increases from 51,112 to 76,900 tons per day. 	<ul style="list-style-type: none"> Peak demand increases from 51,112 to 66,700 tons per day.
Electric Power Demand	<ul style="list-style-type: none"> Maximum demand increases from 74,500 to 132,000 KVA per day. 	<ul style="list-style-type: none"> Maximum demand increases from 74,500 to 107,000 KVA per day.
Peak Water Demand	<ul style="list-style-type: none"> Peak workday demand increases from 3,800 to 6,400 gallons per minute. 	<ul style="list-style-type: none"> Peak workday demand increases from 3,800 to 5,200 gallons per minute.
Sanitary Sewer	<ul style="list-style-type: none"> Peak workday flows to Cedar Lane increase from 2,400 gpm to 4,100 gpm. 	<ul style="list-style-type: none"> Peak workday flows to Cedar Lane increase from 2,400 gpm to 3,000 gpm.
Natural Gas	<ul style="list-style-type: none"> Peak demand increases from 684,000 cf/hour to 1.26 million cf/hr. New transmission line to campus needed. 	<ul style="list-style-type: none"> Increase peak demand from 684,000 cf/hour to 1.03 million cf/hr. New transmission line to campus needed.

TABLE 1-1 SUMMARY OF POTENTIAL IMPACTS. (1 of 3)

CATEGORY	POTENTIAL IMPACT MASTER PLAN ALTERNATIVE	POTENTIAL IMPACT NO ACTION ALTERNATIVE
Noise Traffic Parking Chiller Plant	<ul style="list-style-type: none"> Leq noise levels increase by 2 dBA or less. No impact. Nighttime Leq noise level at NIH property line is maintained at 45 dBA or less 	<ul style="list-style-type: none"> Leq noise levels increase by 2 dBA or less. No impact Nighttime Leq noise level at NIH property line is maintained at 45 dBA or less.
Air Quality Traffic Parking Boiler Stacks	<ul style="list-style-type: none"> Will meet Air Quality Standards. Will meet Air Quality Standards. Will meet Air Quality Standards. Increase in annual pollutant emissions. 	<ul style="list-style-type: none"> Will meet Air Quality Standards. Will meet Air Quality Standards. Will meet Air Quality Standards. Increase in annual pollutant emissions..
Wastes Solid Medical/Pathological Chemical	<ul style="list-style-type: none"> Generation relatively constant. Continue to increase recycling rate. Reduction in generation per researcher offsets growth in researchers Generation relatively constant 	<ul style="list-style-type: none"> Generation relatively constant. Continue to increase recycling rate. Reduction in generation per researcher offsets growth in researchers Generation relatively constant
Cultural Historic Archeological	<ul style="list-style-type: none"> Demolition of Building 7, which is eligible for the National Register. Potential visual effects on campus historic properties. No effect to off-campus properties. Complete Phase I surveys at any potentially “sensitive” archeological sites. 	<ul style="list-style-type: none"> Potential visual effects on campus historic properties. No effect to off-campus properties. No potential impacts.
Trees	<ul style="list-style-type: none"> Potential loss of 500 mature trees. Replacement will occur on a minimum one-for-one basis. 	<ul style="list-style-type: none"> Potential loss of 100 mature trees. Replacement will occur on a minimum one-for-one basis.
Terrestrial/Aquatic Impact	<ul style="list-style-type: none"> No significant impact 	<ul style="list-style-type: none"> No significant impact.
Aesthetics	<ul style="list-style-type: none"> Vast majority of campus 250-foot buffer zone is maintained in open space, with the exception of limited areas required for security-related projects. 	<ul style="list-style-type: none"> Vast majority of campus 250-foot buffer zone is maintained in open space, with the exception of limited areas required for security-related projects, and some surface parking.
Energy	<ul style="list-style-type: none"> Energy consumption continues to grow. The extent of actual growth is dependent upon the success of NIH demand management strategies 	<ul style="list-style-type: none"> Energy consumption continues to grow. The extent of actual growth is dependent upon the success of NIH demand management strategies.

TABLE 1-1 SUMMARY OF POTENTIAL . (2 of 3 Con't)

CATEGORY	POTENTIAL IMPACT MASTER PLAN ALTERNATIVE	POTENTIAL IMPACT NO ACTION ALTERNATIVE
Energy (con't)	Demand increases due to growth in building space and greater demand per unit of space in research facilities.	Demand increases due to growth in building space and greater demand per unit of space in research facilities, but to a lesser extent than the Master Plan Alternative.
Construction Noise Fugitive Dust Wastes	<ul style="list-style-type: none"> Localized noise impacts in vicinity of projects. Localized impacts. Construction could generate 1,500 tons/yr of construction waste. 	<ul style="list-style-type: none"> Localized noise impacts in vicinity of projects. Localized impacts. Construction could generate 1,500 tons/yr of construction waste until 2006.

TABLE 1-1 SUMMARY OF POTENTIAL IMPACTS. (3 of 3 con't)

Context	Mitigation Measure
Traffic	<ul style="list-style-type: none"> • Within legislative and budgetary constraints, implement Transportation Management Plan (TMP) measures that will maintain NIH trip generation at established MOU AM and PM peak hour goals. • Continue to develop and adopt additional TMP measures that reduce NIH Employee single occupancy vehicle mode trips. Possible measures may include expansion of alternate work schedules and telecommuting programs, reorganization of NIH transportation/parking management, increasing the level of traffic and parking monitoring, seeking further TMP budgeting and funding, improving intrafacility and internal campus shuttle service, establishing an Emergency Ride Home Program, establishing a TMP Center, and developing concepts for increased use of satellite parking. • Continue surveys and analysis of campus parking.
Neighborhood Parking	<ul style="list-style-type: none"> • Increase employee awareness of neighborhood parking situation. • Incorporate restrictions in construction contracts that discourage contractors from parking in surrounding residential areas.
Parking	<ul style="list-style-type: none"> • Voluntarily reduce employee parking with a goal of 0.45 employee parking spaces per employee as NIH and regional TMP and legislative changes permit.
Lighting	<ul style="list-style-type: none"> • Follow Master Plan lighting concept plan to increase safety and security while controlling intrusive illumination into residential areas.
Solid Waste	<ul style="list-style-type: none"> • Recycling program with same goals as Montgomery County. • Continue and expand ongoing program for minimization of such wastes as is feasible.
Mixed/Hazardous Waste	<ul style="list-style-type: none"> • Continue and expand ongoing program for minimization of such wastes as is feasible. • Develop an Environmental Management System that includes waste minimization as a key element.
Medical/Pathological Waste	<ul style="list-style-type: none"> • Continue and expand ongoing program for minimization of such wastes as is feasible.
Energy	<ul style="list-style-type: none"> • Incorporate energy conservation designs and features into new and renovated facilities. • Continue to increase energy of steam and chilled water production.
Cultural Historic Archeological	<ul style="list-style-type: none"> • Complete Section 106 process in planning/design phase for major projects which may affect potentially historic structures. • Complete Phase I, and if necessary, Phase II and III Surveys prior to construction of projects proposed for archeological sensitive areas.
Terrestrial Vegetation	<ul style="list-style-type: none"> • Prepare a campuswide Forest Stand Delineation Plan. • Complete Forest Conservation and Protection Plans for construction projects that affect mature trees. • Maintain 15% tree canopy cover on a campuswide basis.
Aesthetics	<ul style="list-style-type: none"> • Concentrate large buildings in the central core of the campus and reduce building heights as one approaches the perimeter buffer. • Provide additional plantings in perimeter buffer area on north, west, and south sides of the campus to screen residential neighborhoods.

TABLE 1-2 MITIGATION MEASURE SUMMARY. (1 of 2)

Context (cont'd)	Mitigation Measure (cont'd)
Aesthetics (cont'd)	<ul style="list-style-type: none"> • Provide plantings in east side buffer area to minimize visual effects on Naval Medical Center Hospital Tower.
Construction Noise Fugitive Dust Scheduling Traffic	<ul style="list-style-type: none"> • Mix Concrete off site, where feasible. • Use electric driven equipment, where feasible. • Use hydraulic instead of pneumatic tools, where feasible. • Schedule noisy operations to coincide with high ambient noise. • Turn off idling equipment when not in use. • Provide enclosures around stationary equipment, where feasible. • Require silencers on compressors. • Contractors comply with State regulations. • Seed and stabilize disturbed areas. • Provide stabilized stone construction entrances. • Apply spray-on adhesives to mineral soils as appropriate. • Sprinkle or wet high dust areas as appropriate. • When feasible, limit work to 7 AM to 4 PM, Monday through Friday. • Route construction traffic to NIH entrances away from adjacent neighborhoods. • Include provisions for contractor employee use of transit in contract documents.

TABLE 1-2 MITIGATION MEASURE SUMMARY. (2 of 2 cont'd)

Council on Environmental Quality, 1978). It is NCPC policy that federal developments and projects requiring NCPC review and comment also satisfy all NEPA requirements using the criteria established by CEQ before NCPC review.

A Master Plan approved by NCPC is necessary for construction of any major projects proposed in the plan. On the other hand, NCPC Master Plan approval does not imply NCPC approval of construction of specific projects. When individual major projects are proposed for construction, project specific environmental documentation and NEPA public involvement will be completed, where warranted. NIH would also prepare a revision to its Master Plan when significant deviations from the approved Master Plan are proposed.

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Section Two

Existing Conditions

2.1 PROJECT LOCATION

The NIH Bethesda campus is located in Montgomery County, Maryland, approximately three miles north of Washington, D.C. (Figure 2-1). The Bethesda Central Business District is situated immediately to the south. The campus is bounded on the east by Rockville Pike (Maryland Route 355), a six lane arterial road that passes through a continuous commercial corridor extending from Bethesda to Gaithersburg, about four miles north of Rockville. Old Georgetown Road (Maryland Route 187) and West Cedar Lane form the western and northern boundaries, respectively (Figure 2-2).

The campus is in the Washington, D.C. metropolitan area. It is surrounded in all directions by solid urban and suburban development. This development extends four miles to the west of the campus, and much greater distances in other directions. The U.S. National Naval Medical Center shares frontage with NIH along Rockville Pike for most of NIH's eastern boundary. Single and multifamily residential neighborhoods lie on the other three sides. The Washington Metropolitan Area Transit Authority (Metrorail) Red Line route follows the alignment of Rockville Pike through the area. The Medical Center underground rail station, which also has surface bus transit service, is located on the east side of the campus.

2.2 NIH ORGANIZATION

NIH is part of the U.S. Department of Health and Human Services. The congressionally mandated mission of NIH is to provide leadership and direction to programs that improve the health of the people of the U.S. NIH seeks to accomplish its mission by:

- Fostering fundamental discoveries, innovative research, and their applications in order to advance the Nation's capacity to protect and improve health.
- Developing, maintaining, and renewing the human and physical resources that are vital to ensure the Nation's capability to prevent disease, improve health, and enhance quality of life.
- Expanding the knowledge base in biomedical and associated sciences in order to enhance America's economic well-being and ensure a continued high return on the public investment in research.
- Exemplifying and promoting the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science.

The following is a partial list of organizations on the campus:

2.2.1 Office of the Director

- Director of NIH

Provides leadership and direction to NIH programs and activities in both scientific and administrative matters, and advises the Assistant Secretary for Health in the formulation of national health policy.

- Office of Management (OM)

Advises the Director and NIH staff on administration and management. Organizations within the Office of Management include the Office of Administration, Office of Human Resource Management, Office of Financial Management, Office of Research Services, and the Office of Research Facilities Development and Operations.

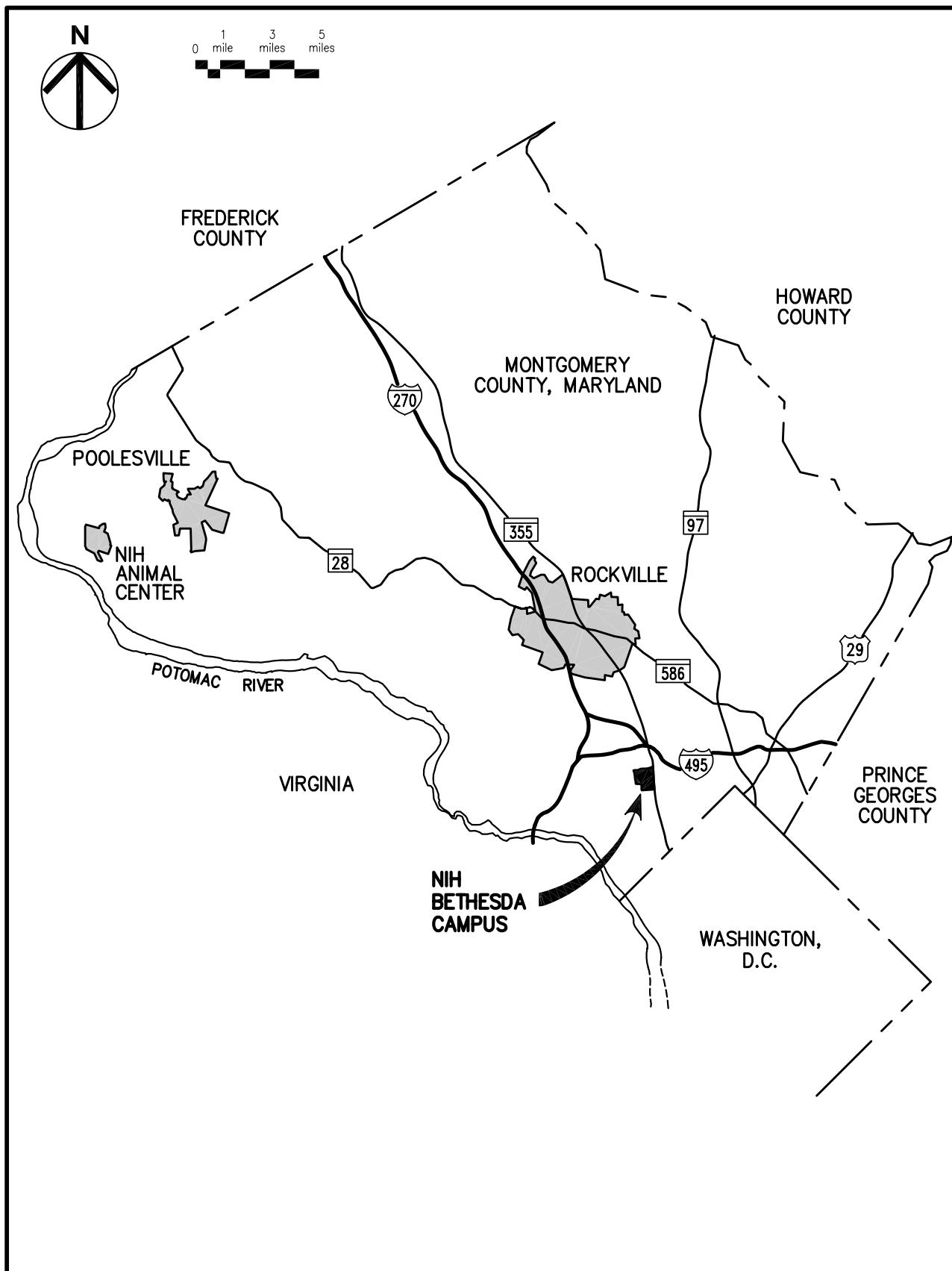


FIGURE 2-1 MONTGOMERY COUNTY LOCATION MAP.

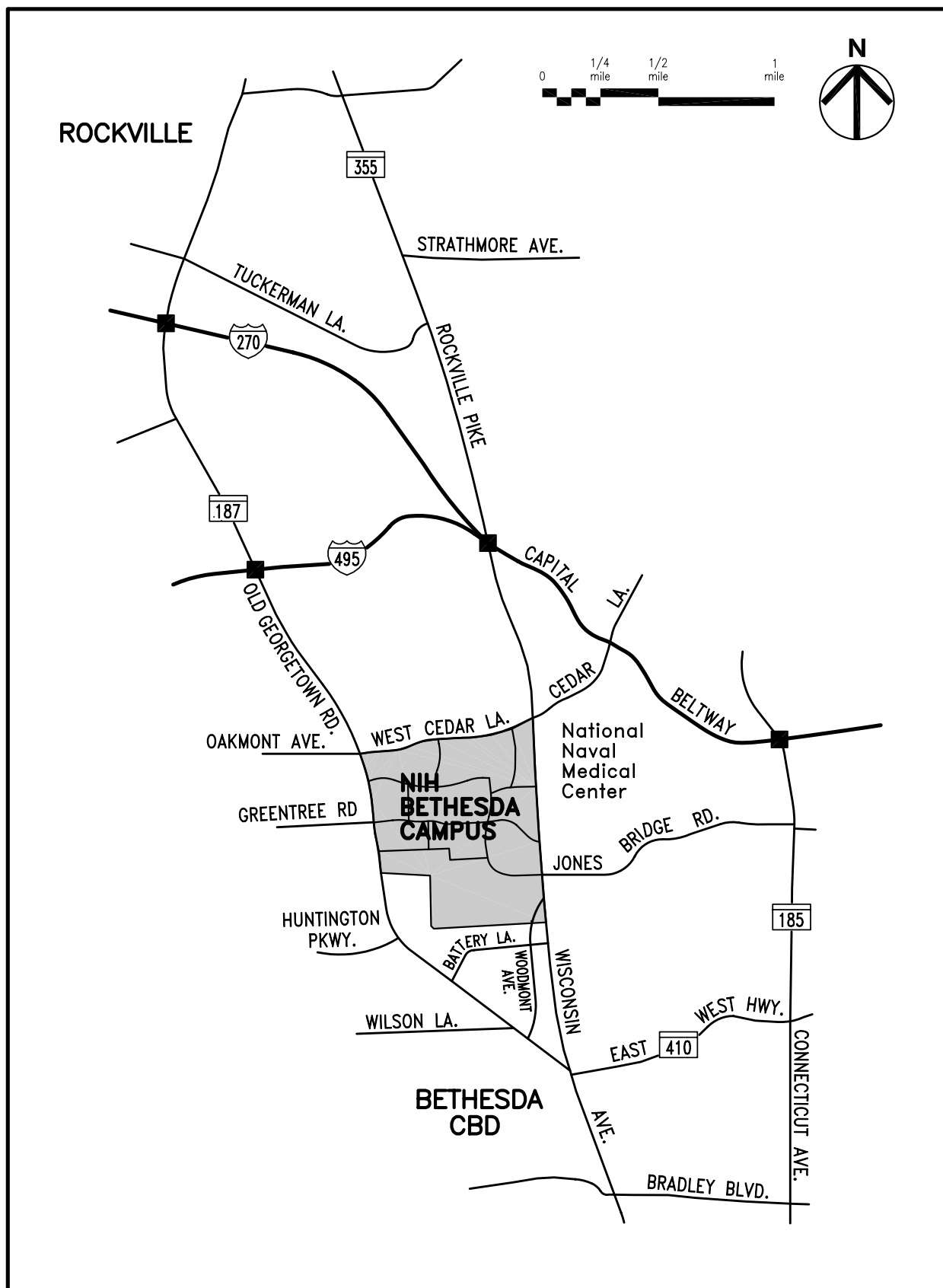


FIGURE 2-2 VICINITY MAP.

- Office of Extramural Research (OER)
On behalf of Director, provides guidance to NIH Institutes in research and training programs completed for NIH through extramural (grant, contract, cooperative agreement) programs.
- Office of Intramural Research (OIR)
Oversees and coordinates research, training, and technology transfer among the laboratories and clinics of NIH around the U.S.
- Office of Communications and Public Liaison (OCPL)
Advises NIH Director, and communicates information about NIH policies, programs, and research results to the general public, scientific community, and medical professionals.
- Office of Science Policy (OSP)
Advises the Director on policy issues, and participates in the development of new policy and program initiatives.
- Office of Disease Prevention (ODP)
Coordinates NIH activities regarding application of research to disease prevention, nutrition, and medical practice.
- Office of AIDS Research (OAR)
Formulates scientific policy for and recommends allocation of research resources for AIDS research at NIH.
- Office of Equal Opportunity and Diversity Management (OEODM)
Advises the Director and NIH staff on matters related to equal employment opportunity programs and policies.
- Office of Research on Women's Health (ORWH)
Advises the Director, formulates scientific policy, and recommends funding allocations for research specifically related to women.
- Office of Community Liaison (OCL)
Advises the Director on, and plans, directs, and manages activities to promote collaboration between NIH and the community. Ensures effective communication on NIH policy and programs involving the community.

2.2.2 Institutes (with date of inception)

- National Cancer Institute (NCI) (1937)
Conducts, supports, and coordinates research on detection, diagnosis, prevention, control, and treatment of cancer.
- National Heart, Lung, and Blood Institute (NHLBI) (1948)
Conducts and coordinates research in diseases of the heart, lungs, blood vessels, and blood, as well as their treatment and prevention. NHLBI also has administrative responsibility for the NIH Women's Health Initiative.

- National Institute of Dental and Craniofacial Research (NIDCR) (1948)
Conducts and coordinates research into infectious diseases and inherited disorders of the teeth, mouth, jaws, and face; their prevention; and normal oral and facial development.
- National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) (1948)
Conducts and supports research in diabetes, digestive diseases, nutrition, and obesity; endocrinology and metabolic diseases; and kidney, urologic, and hematologic diseases.
- National Institute of Allergy and Infectious Diseases (NIAID) (1948)
Conducts and supports research into diagnosing, treating, preventing and causes of infectious, immunologic, and allergic diseases including childhood diseases, sexually transmitted diseases, AIDS, asthma, and autoimmune disorders.
- National Institute of Mental Health (NIMH) (1949)
Conducts and coordinates research on diagnosis, treatment, and prevention of mental disorders and illnesses.
- National Institute of Neurological Disorders and Stroke (NINDS) (1950)
Conducts and supports research into more than 600 diseases and disorders that affect the brain and neurological system including Parkinson's, Alzheimer's, epilepsy, strokes, and head injuries.
- National Library of Medicine (NLM) (1956)
National repository of biomedical research and medical information with computer search facilities available to nation's physicians, research scientists, health care professionals, and the general public.
- National Institute of General Medical Sciences (NIGMS) (1962)
Conducts and supports basic research that is not targeted to specific diseases and disorders, or that is related to basic and general medical science.
- National Institute of Child Health and Human Development (NICHD) (1963)
Conducts and supports research into fertility, pregnancy, human growth and development, and pediatrics.
- National Eye Institute (NEI) (1968)
Conducts and supports research on the causes, natural history, prevention, diagnosis, and treatment of disorders of the eye and visual system.
- National Institute of Environmental Health Sciences (NIEHS) (1969)
Conducts research into health and human diseases resulting from genetic susceptibility, environmental factors, and time.
- National Institute on Alcohol Abuse and Alcoholism (NIAAA) (1970)
Conducts and supports research on the cause, treatment, and prevention of alcoholism and alcohol related problems, including studies in genetics, neurosciences, and pharmacological treatment.
- National Institute on Drug Abuse (NIDA) (1973)
Conducts research and provides national leadership on drug abuse and addiction focusing on causes, consequences, prevention, and treatment in biological, social, behavioral, and neurological areas.
- National Institute on Aging (NIA) (1974)
Conducts and supports research on the biomedical, social, and behavioral aspects of the aging process, and the prevention of age related diseases and disabilities.

- National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) (1986)
Conducts and supports research on diseases and disorders of the joints, bones, muscles, and skin, rheumatology, orthopedics, dermatology; and sports medicine.
- National Institute of Nursing Research (NINR) (1986)
Conducts and supports research in patient care to establish a scientific basis for care across the life span.
- National Institute on Deafness and Other Communication Disorders (NIDCD) (1988)
Conducts and supports research on normal mechanisms and diseases and disorders of hearing, balance, smell, taste, voice, speech, and language.
- National Human Genome Research Institute (NHGRI) (1996)
Was established as the National Center for Human Genome Research in 1989. Conducts and supports research characterizing the human genome through mapping and sequencing of DNA, genetics, and technologies for genomic analysis.
- National Institute of Biomedical Imaging and Bioengineering (NIBIB) (2000)
NIBIB conducts and coordinates research that translates physical, chemical, and mathematical science and engineering principles into technical biomedical engineering and bioengineering development.

2.2.3 Centers

The following Centers are principally involved with research.

- Warren G. Magnuson Clinical Center (1953)
Provides patient facilities and services for clinical investigation and trials in 270 bed research hospital; conducts research in clinical care, hospital administration, and related areas. The Magnuson Clinical Center will be replaced by the Mark O. Hatfield Clinical Center in 2004.
- Fogarty International Center (FIC) (1986)
As the organizational focus for NIH's international activities, FIC promotes collaborative research on causes and prevention of diseases of global impact, and disseminates NIH findings internationally.
- National Center for Research Resources (NCRR) (1990)
Conducts research on human, animal, technological, and other resources used in biomedical research with emphasis on biomedical technology, clinical research, and research infrastructure.
- National Center for Complementary and Alternative Medicine (NCCAM) (1999)
Previously, the Office of Alternative Medicine which was established in 1993. Studies and disseminates information on complementary and alternative therapies in the context of rigorous science.
- Center for Scientific Review (CSR) (2000)
Previously the Division of Research Grants, which was established in 1946. The Center supports the Office of the Director in the formulation of research grant policies and procedures, administers peer review of extramural research and manages and monitors research grants and fellowships.
- National Center on Minority Health and Health Disparities (NCMHD) (2000)
Previously the Office of Research on Minority Health. The Center has overall responsibility for coordinating NIH policies, goals, and objectives related to minority research and training programs. Conducts and coordinates research on minority health.

- Center for Information Technology (CIT) (2000)

Established as a Division in 1964, the Center coordinates and manages information technology, conducts computational bioscience research, and develops and maintains NIH computer networks and systems.

2.3 EXISTING NIH FACILITIES

Administrative headquarters for NIH are located on the 310 acre Bethesda campus, which is also the focus for clinical research conducted by NIH scientists and physicians. About 17,500 people work on the campus including NIH employees, visiting research fellows, intramural research trainees, and contractor personnel who operate cafeterias, banks, and other services, collect wastes of all types, and provide janitorial services. Approximately 60% of all NIH employees in the U.S. work on campus. Over 8,000 of the workers are scientists/physicians or postdoctoral trainees involved directly with research.

These employees work in about 50 major and 25 minor buildings that have a floor area of about 7,400,000 gross square feet (gsf) (Figures 2-3, 2-4 and Table 2-1). See Appendix A for larger scale site mapping of the existing campus with site topography.

The focal point of the campus is the Warren G. Magnuson Clinical Center, a 270-bed research hospital with laboratories, where clinical trials involving direct application of biomedical science and experimentation to volunteer patients take place. The original section of the Clinical Center, Building 10, was opened in 1953, but many wings and annexes have been attached over the intervening years. About 6,500 workers are employed in the 2,385,000 gross square feet (gsf) complex, which also has an additional 568,000 gsf of underground parking. About 4,000 of the Clinical Center staff are engaged in research or its support, and about 2,000 support the hospital program. The Building 10 complex ranges from 8 to 14 stories in height.

The Clinical Center Complex encompasses facilities in Building 10, the Ambulatory Care Research Facility, and the new Mark Hartfield Clinical Research Center, which will replace the Magnuson Center. It is surrounded on the east and southwest sides by Institute buildings that conduct basic research and support clinical research in the Clinical Center. The buildings to the east of the Clinical Center Complex are part of the original NIH development and are generally three to five stories in height. Those to the southwest are newer, and are six to eight stories in height.

Most of the campus administrative offices are located in the eastern sector of the campus. The largest concentration of offices are in the 7 to 11 story Building 31 complex in the northeast corner of the campus. Building 45, the Natcher Building, on the east side of the campus provides 245,000 gsf for administration and conference space in a six story structure. The National Library of Medicine is located to the south of the Building 45 site. Building 82, which is not included in the master planning process, is located in the southwest quadrant of the West Cedar Lane/Old Georgetown Road intersection outside the limits of the Bethesda campus proper. It is a small two story office building donated to NIH by the Bloch family for administration of cancer research.

Animal holding and care facilities are concentrated in Buildings 14 and 28 on the south side of the campus. These buildings are sprawling single story structures. Many of the research buildings built since 1995 also contain animal holding areas.

The largest support facility is the central heating and refrigeration plant located in Building 11 in the core area of the campus. Also identified as the "power plant" in this document for brevity, Building 11 houses boilers which generate steam for heating most of the campus buildings as well as for building humidity

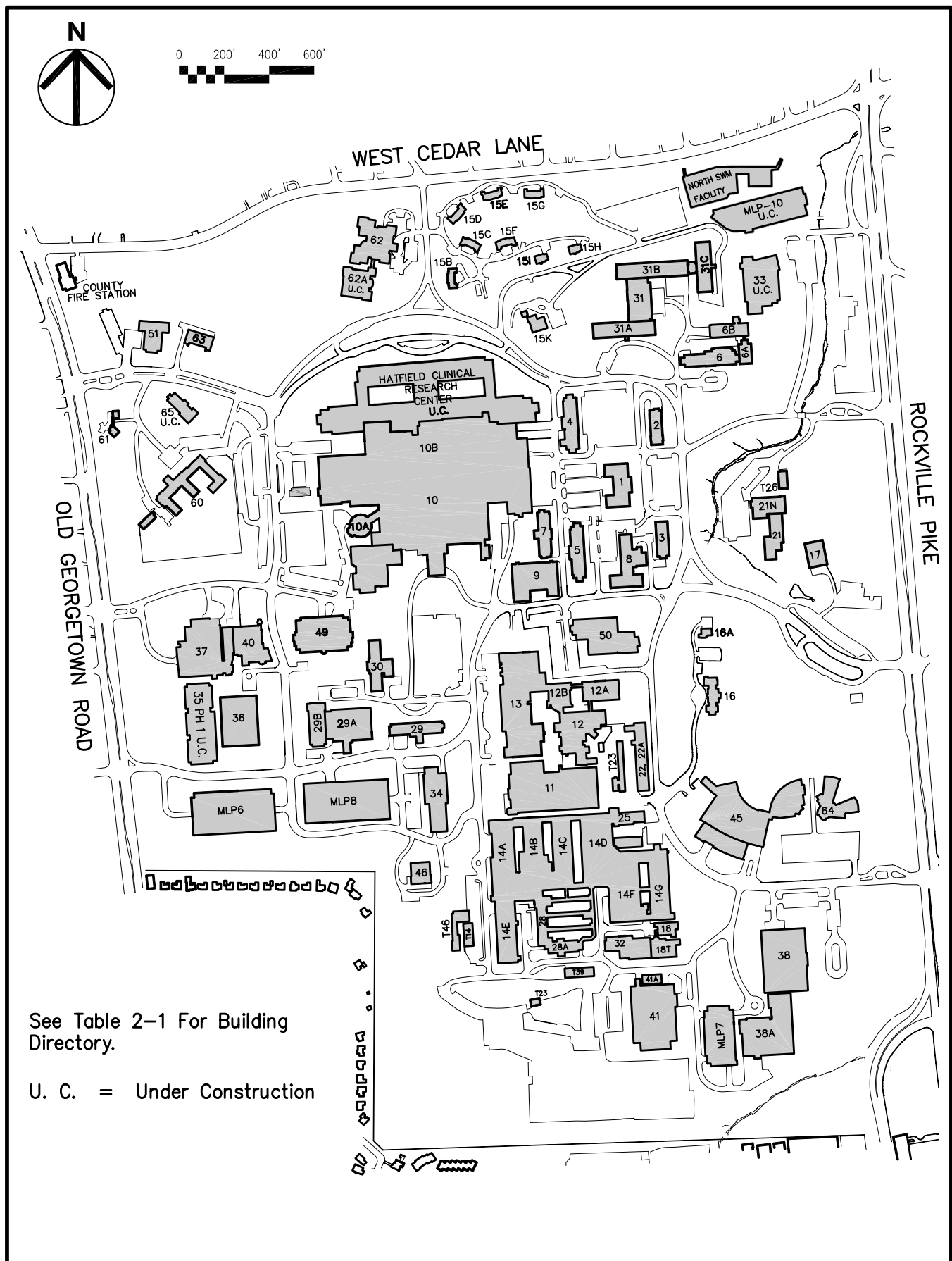


FIGURE 2-3 EXISTING NIH BUILDINGS.

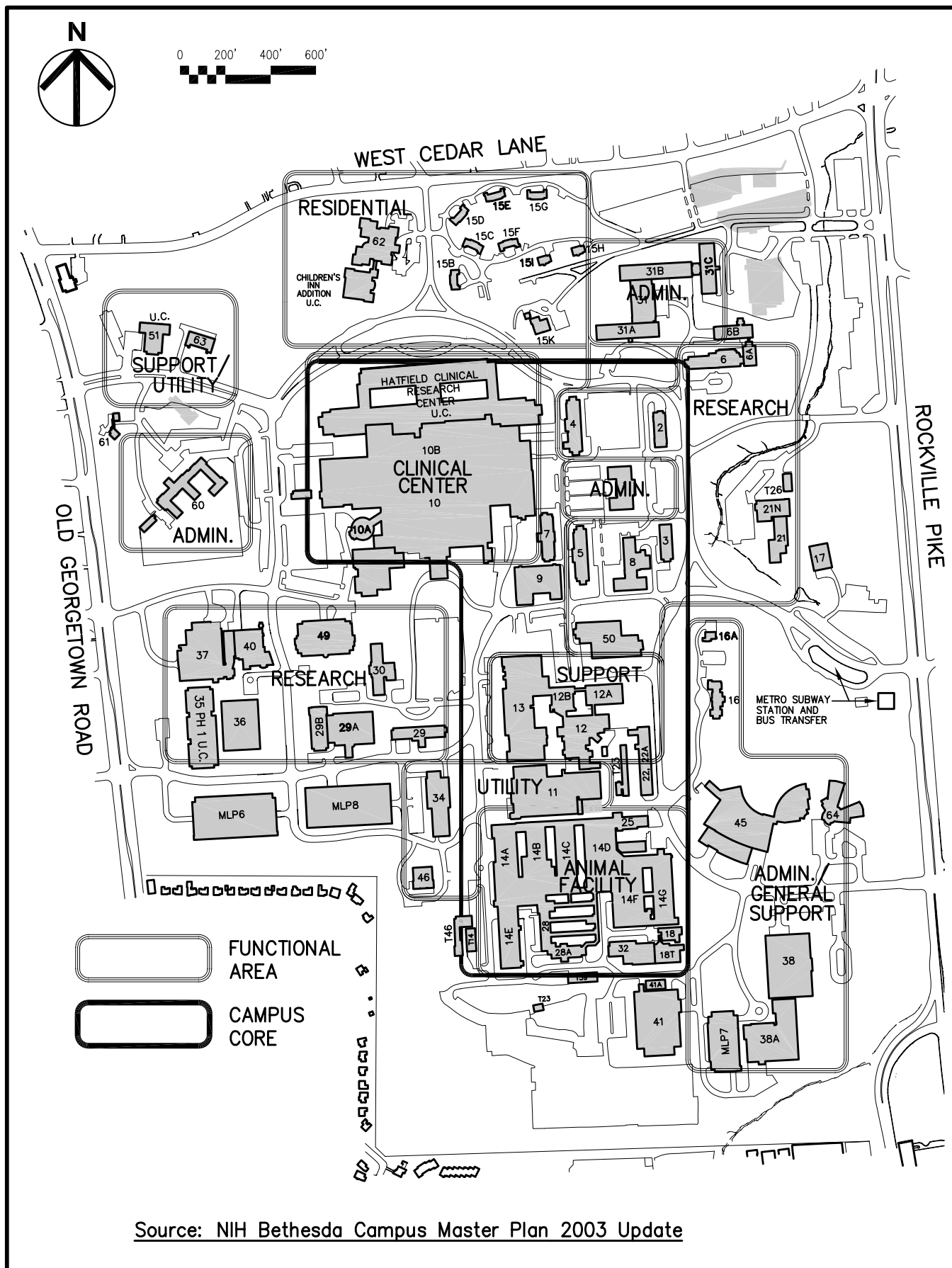


FIGURE 2-4 GENERAL NIH FUNCTIONAL AREAS.

Bldg. Number	Function	Bldg. Number	Function
1	Headquarters Administration	31 A, B, C	Administration
2	Administration Offices	32	NICHD Research
3	NHLBI Research	34	Refrigeration Plant No. 2
4	NIAID Research	36	NCI/NHLBI/NICHD/NIDCD/ NIMH/NINDS Research
5	NIDDK Research	37	NCI Research
6, 6A&B	NEI/NIAMS/NICHD Research	38	National Library of Medicine
7	NIAID Research	38A	Lister Hill National Center
8	NIDDK Research	40	Vaccine Research Center
9	NIMH/NINDS Research	41	NCI Virus Research
10	Magnuson Clinical Center	41A	Laboratory
10A	MRI Facility	45	Office Building & Conference Center
10B	Ambulatory Care Research Facility	46	NIH/PEPCO Substation
11	Central Boiler/ Refrigeration Plant No. 1	49	Child Health and Neurosciences Laboratory
12	CIT, Gov't Vehicle Garage	50	Louis Stokes Research
12A	CIT Offices	51	Fire Station
12B	CIT	60	Mary Woodard Lasker Center
13	Support Services Building	61 & 61A	Office/Storage
14	Animal Facility	62	Children's Inn
15B	Office	63	North Electric Substation
15 C,D,E, F,G,H,I	Residential Staff Quarters	64	East Child Care Center
15K	Research	T2	Storage
16 & 16A	Fogarty International Center	T14	Storage
17	NIH/PEPCO Substation	T23	Grounds Maintenance Storage
18 & 18T	NICHD Research	T39	Fitness Center
21	Radiation Safety Facility	T46	Southwest Child Care Center
21A	Hazardous & Radioactive Waste Management Facility	MLP	Multilevel Parking Garages
22 & 22A	Grounds Maintenance Support Facility	33*	Research Building
25	Waste Management	35*	Neuroscience Research Center Phase I
28	Animal Facility	62*	Children's Inn Addition
29	FDA Research	65*	Family Lodge
29 A & B	FDA Research	CRC*	Hatfield Clinical Research Center
30	NIDCR Research		
* Under Construction Note: See Table 4-1 for building areas and types.			

TABLE 2-1 NIH BUILDING DIRECTORY.

control, equipment sterilization, steam cleaning of animal facilities, and lab bench use. Building 11 also contains chillers and cooling towers which produce chilled water for summer air conditioning of buildings and for laboratory use and cold rooms throughout the year. Building 34 houses six older chillers that were installed in 1952 when chilled water demands created by campus growth temporarily exceeded the capacity of chillers in Building 11. NIH shops, support personnel offices, and warehouse storage are located in Building 13, a three story structure to the north of the power plant. The Building 21 complex on the east side of the campus south of Wilson Drive houses treatment, storage, and disposal facilities for radioactive, chemical, and mixed wastes. Building 21 is two stories in height.

The north central portion of the campus is a residential area. Small children and adolescents who are long-term patients at the Clinical Center can obtain temporary relief from the hospital environment with their families in the Children's Inn on the west side of West Drive. NIH senior staff residences are located to the east of the Children's Inn.

Seven building projects are currently in various stages of construction.

- The Mark Hatfield Clinical Research Center located on the north side of Building 10. It will replace the existing research hospital in the Magnuson Clinical Center with a 240-bed hospital for clinical research.
- The Neuroscience Research Center, Phase I, located on the west side of the campus.
- Building 62A, an addition to the Children's Inn, on the northern periphery of the campus.
- Building 65, the Family Lodge, which will house families of patients staying in the Children's Inn or the Clinical Research Center hospital for extended periods. It is located to the west of the Clinical Center.
- Multilevel Parking Lot 9 (MLP-9) on the west side of the Clinical Center.
- MLP-10 located in the northeast corner of the campus.
- Building 33, a new research laboratory, which is also located in the northeast corner.

Occupancy of the first six projects is scheduled for 2004. Building 33 is scheduled to open in 2005.

The campus "core" is an area with comparatively low topographic relief. The southern portion of the core is located on fill placed in the original NIH Stream valley. Existing buildings and utilities are densely concentrated in the core area. Virtually all of the core area has been disturbed by prior construction, or is located on an extensive fill that has buried the NIH Stream valley as it crosses the campus.

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Section Three

Purpose and Need

3.1 PURPOSE

The mission of NIH, as delineated in the original and amended federal legislation directing the agency's activities, is to conduct biomedical research, educate and train researchers, assist in the transfer of technology, and disseminate information in the biomedical and associated sciences on behalf of the health and welfare of American citizens. The purpose of the Master Plan is to provide guidance for realistic, orderly, and comprehensive physical development of the Bethesda campus so that NIH can continue to perform its mission. Many of the campus research and clinical facilities have aged beyond their expected useful life. The Master Plan is a keystone planning element in the modernization of these physical facilities. Improvements to the physical plant, in turn, will lead to an enhancement of the missions carried out by NIH at the Bethesda campus.

The Master Plan 2003 Update is a revision of the 1995 Bethesda Campus Master Plan, and is identified as the "Master Plan". It accounts for physical and other changes within and without the campus that have occurred in the interim. The Master Plan outlines a coordinated long term land use strategy for the campus. It establishes a conceptual integrated framework for physical development that permits NIH to organize the arrangement of potential future buildings, necessary supporting infrastructure such as roads and utilities, access, and open areas cohesively. Potential development sites and natural areas to be protected are identified. General conditions, criteria, and constraints are delineated. An approximate sequence of steps for implementation of the plans and reaching the development objectives is outlined. It is also the intent of the Master Plan to encourage active dialogue among NIH management, the NIH scientific and support community, and the general public and citizens by fostering a better understanding of the ramifications of proposed policies and plans.

NIH administrators, planners, architects and engineers, when implementing individual projects, will use information and recommendations in the Master Plan. Local jurisdictions and utilities can use this same source to anticipate and plan for the effects that NIH proposals may potentially have on their infrastructure and systems.

It is important to note that a master plan is a document of broad and general scope. It must be flexible, and is not a fixed blueprint. Variances within the constraints established in the Master Plan are expected to occur. Small projects needed for immediate ad hoc operations, routine maintenance and repair projects, and other projects that produce no significant permanent impact, are not necessarily delineated. Personnel and space estimates covering the next five years, including projects now under design or construction are established with some degree of confidence. As the planning period is extended to 10 years and beyond, projections become increasingly speculative and contingent.

All the growth and projects depicted in the Master Plan may not occur. On the other hand, NIH must respond to future Congressional and Presidential decisions regarding its mandated mission. These policy decisions, in turn, reflect demands and pressures applied by the American people. Changes in the national health policy can be expected over the next decade, and within its mission, directives to NIH could change as a result. While one strong point of NIH is the ability to react to new directives and mandates using existing facilities and personnel, many conditions, such as new fields of research, could lead to changes in growth forecasts at NIH over the next 20 years from those proposed in the 2003 Draft Master Plan Update.

Although the Master Plan covers a planning horizon or period of 20 years, it is the intent of NIH to review the Bethesda campus Master Plan at approximately five year intervals. The incremental effect of campus growth during the five year interval would be assessed, if this should occur, and evaluated with community input and participation. The five year Master Plan reevaluations and updates would be critical

in this process.

3.2 NEED FOR MASTER PLAN

Intramural research is research conducted by NIH scientists, doctors, and visiting researchers and post-doctorate trainees at NIH facilities. NIH researchers and staff also administer, monitor, and review biomedical research programs completed by private and non-federal institutions under NIH-funded contract or grant programs. The latter is defined as extramural research. Personnel in NIH office buildings outside the campus around Montgomery County are primarily involved in administration and management of extramural programs. NIH also has mandated missions to train and educate biomedical researchers and provide an exchange of biomedical research information.

The intramural research program possesses several unique characteristics that set it apart from the extramural program. Funding for this research is long term and relatively stable, the Clinical Center patient investigative facilities are readily available, and there are few, if any, administrative and management distractions for scientists engaged in research. It must be emphasized that a strong extramural research program requires a vigorous and high quality intramural research program. The quality of the intramural program, in turn, is dependent on the ability of NIH to recruit, attract, and retain highly qualified senior scientists and promising young investigators. Since NIH must compete with universities, research institutes, hospitals, and the private biomedical research sector for scientific personnel, its ability to recruit is influenced by the quality of its physical facilities and character of the campus in comparison to other research facilities.

To accomplish its purpose and mission, NIH is organized into Institutes and Centers (ICs). Through the Clinical Center, these ICs are closely interwoven into an integrated organization and network that can function efficiently only if nearly all elements of the organization are present on campus. While each Institute or Center nominally concentrates on and is responsible for specific areas of biomedical research and training, working relationships as complex as those between organs in the human body exist between them. Other organizational components provide essential and specialized services to all of the Institutes and Centers under centralized control.

In dozens of interviews conducted to determine future research personnel and space requirements, directors of the ICs repeatedly expressed the need for maintaining a "critical mass" of facilities, personnel, talent, and support on the campus that is essential for the conduct of the U.S. biomedical research program, not only at NIH, but also throughout the U.S.

Studies conducted by NIH along with 2,000 representatives of the scientific community indicate that basic and clinical research will become even more integrated and related in the near future. A clear understanding of the need for facilities and personnel can only be gained, albeit superficially, by a deeper look at the functioning of the NIH organization at Bethesda and its functional relationships.

3.2.1 Clinical Center - Research Relationships

The heart of the NIH Bethesda campus is the Warren Magnuson Clinical Center, about which research activity revolves. The Clinical Center is located in the Building 10 complex that encompasses more than 2.3 million square feet of occupiable floor space. The center is the focal point where biomedical science and research at the laboratory bench is rapidly transformed into practical treatments and accepted medical practice through direct interface with human patients. Most of the functions of the Magnuson Clinical Center will be transferred to the new state of the art Mark Hatfield Clinical Research Center when the

latter opens in 2004. Hospital spaces in the Magnuson Center will then be converted to clinical research.

A clinical center is a place where clinical trials are conducted. Classically, clinical trials are tests or protocols where one group of patients is given a medical or surgical trial treatment or procedure, while a second group is given nothing (placebo) or an alternative procedure. The efficacy of the two treatments or procedures is compared. NIH uses its Clinical Center in many ways other than the classical one to advance biomedical research.

The NIH Clinical Center hospital has many of the facilities found in a general hospital, but unlike most hospitals, the Clinical Center does not offer diagnostic or treatment services to the general public. Yet, some 6,500 employees including 1,200 full time physicians and 600 registered nurses work in the complex. About 4,000 of the Clinical Center staff are engaged in research while about 2,000 support the hospital program. All clinical services are free of charge. All patients in clinical trials are volunteers.

Patient admission is selective. They are chosen by Institute physician researchers based on a number of factors. Some are selected on information supplied by referring doctors who may be the patient's family physician. Others have a medical condition under study. They can include the chronically and terminally ill, those with rare diseases, disorders, and conditions, and those willing to undergo new procedures with greater uncertainty in the risks involved. Patients are recruited nationally, and in cases of some rare diseases, internationally. Over 6,500 people are admitted for study and treatment annually as inpatients. Many inpatients remain for weeks or months, although the average stay is only 7.4 days. Outpatients may live at home and report daily, weekly, monthly or at some other interval. Approximately 74,000 outpatients visit the Clinical Center annually.

Patients also include healthy individuals. Five hundred healthy people are admitted annually as normal volunteers representative of the American population in general, and over 11,000 healthy subjects have been tested at the Clinical Center. They provide vital information on the physical and mental characteristics of good health, early signs of disease or dysfunction, and the effects of aging over a long period.

Upon admittance, patients are assigned to the care of a "clinical associate", a full time physician, who will be responsible for the patient and for conducting the research studies for which the patient is admitted. Extensive oral and written interviews, examinations, and testing are performed on the patient. Collected information, along with that generated during the study, is entered into a computerized data bank in the Center.

Information about the patient's medical condition and status is passed through computer printout to other researchers on the campus. If the patient is willing to participate voluntarily, he or she may be introduced to further experimental clinical procedures or testing for vital information under the auspices of a second or third clinical associate. These further procedures may be done simultaneously or sequentially with the primary studies depending on the protocol worked out among the clinical associates. Patients may have to endure procedures well beyond that encountered in a general hospital. They may be connected to monitoring or measuring equipment or have repeated tests or samples taken for weeks at a time. They may ingest radioactive isotopes to trace substances passing through and around the body. Genetic material may be extracted. The experimental procedure may have unforeseen side effects.

The Clinical Center at NIH is the largest and most advanced center in the world devoted exclusively to research. About half of all the dedicated federally funded clinical research patient beds in the U.S. are at the Clinical Center. About 50% of all U.S. clinical research is done at NIH Bethesda.

Each floor of the Clinical Center Complex hospital has patient wards and biomedical research

laboratories. Laboratories may be directly across the hallway or adjacent to patient rooms. There are about 1,600 individual laboratory and research spaces, and 270 patient beds in the complex. In response to a review of Clinical Center operations, several institutes indicated that bed-laboratory adjacency was of considerable value in facilitating transitional basic and clinical research. It is estimated that about 49 percent of the laboratory facilities are on the same floor as complementary clinical facilities. The ICs further indicated that it is desirable to have an additional 38 percent of their clinical and laboratory facilities in the same building, if they could not be placed necessarily on the same floor.

Research scientists and clinical physicians work side by side directly with patients. Observations at the bench in the laboratory quickly yield ideas for clinical application. Clinical observation at the bedside can be tested at once, quickly stimulating new areas for scientific inquiry. It is estimated that clinical trial results at NIH are obtained in about half the time it takes at standard hospitals and extramural facilities.

Clinical programs involve extensive collaborations among research groups. During 2002, over 900 protocols involving 81,900 inpatient and outpatient visits were active in the Clinical Center. Of these protocols, 50 percent were therapeutic, 35 percent concerned pathogenesis or natural disease history, and the remainder evaluated new diagnostic procedures. Some clinical trials were in their fourth phase of study.

3.2.2 Institute-Clinical Center Research Relationships

The NIH Bethesda campus has the largest concentration of biomedical scientists and clinical researchers in the world. Over 4,000 campus personnel have Ph.D. or M.D. degrees, or both. All biomedical academic disciplines are covered in this one location. World renowned experts who are aware of the latest advances on the fringes of science, medicine, and research protocols are present. Specialists are available in new investigative areas.

Similarly, the wide variety of resources available in laboratory spaces, equipment, chemicals, biological agents, and other support facilities accelerates research at NIH. Costly equipment can be shared or borrowed. Elaborate equipment can be operated by specialists. In a few cases, NIH is the only location with a specific resource. Handling and management of research and Clinical Center Complex wastes are centralized.

The Institute research laboratories and facilities outside Building 10 are operationally tied to the laboratories and facilities in the Clinical Center Complex. Research completed elsewhere on the campus is frequently related to that undertaken in the Clinical Center. It may be clinical research not requiring daily contact with patients. Individual scientists and clinical physicians may transfer back and forth between laboratories in other buildings and the Clinical Center as experimental conditions dictate. Outlying laboratories not only have access to the Clinical Center patient computer data bank, but also have access to tissues, genes, bacteria, viruses, and other materials extracted from patients for use in laboratory experiments.

Modern biomedical research has become increasingly complex and interdisciplinary. Work is progressing from microscopic to the molecular, from the study of bacteria and viruses to genes. At this level, differences between disciplines of study, and between pure scientific research in the laboratories and clinical research, become blurred. While individual institutes have the strongest ties to their own programs, there are also complex administrative and research relationships among the ICs. Intramural collaborative efforts are increasing and are expected to continue to do so with increased emphasis in genetic research and therapies.

The accomplishments of scientists in the NIH intramural research program are numerous, and cover a broad spectrum of inquiry. Intramural scientists have made important contributions to the advancement of biomedical science that have benefited the health and quality of life of the general public. Examples include solving the genetic code; elucidating the metabolism of adrenalin hormones and drugs in the body; unraveling the mechanism for protein folding; discovering slow viruses and their causative role in diseases; developing the blood test for AIDS; and uncovering the role of viruses in tumor development.

Research in any one of a number of parallel programs among the Institutes may trigger an insight leading to cure or control of the affliction. Researchers attend formal and informal seminars and conferences on the campus which reveal final results or results in progress. Conferences reveal the results of extramural research as well as that done on campus. Researchers also maintain informal contact. They are helped significantly by the quick exchange of information between groups that subsequently has synergistic effects on the overall effort. Based on the information transferred, some experiments may be stopped, others shifted in direction, and promising new ones started.

Over the last decade, the trend in collaboration among the Institutes has increased significantly. Researchers from a number of Institutes share facilities in Building 40, the Vaccine Research Center, which opened in 1999. Researchers from ten individual NIH Institutes will occupy the Neuroscience Research Center, now under construction, to conduct unified biomedical research involving the head, brain, and neurological systems.

The NIH intramural research program is also unique in that it is not subject to grant programs and income pressures as are private sector biomedical facilities. Requirements in most academic institutions lead most investigators outside NIH to select research topics that will yield prompt results. Since research grants are renewed competitively every few years, no results mean no renewal. Elimination of these pressures permits the NIH intramural research program to undertake several types of studies including interdisciplinary studies between Institutes which are essential, but not possible in the private arena. These include:

1. Long term biomedical studies
2. Quick response investigations
3. Low potential yield investigations
4. Verification - refutation studies
5. Disinterested advice and opinions

- ***Long-Term Studies***

NIH undertakes clinical and laboratory studies which may take years or decades to yield fruitful results. For example, one study by the National Institute on Aging (NIA) involves the recurrent and thorough examination of a large cohort of nominally healthy patients to study the physiological, biochemical, and psychological status of the individuals as they grow older. Already the study has demonstrated that many conditions previously accepted as part of the aging process, such as memory loss and excessive fatigue, are caused by treatable diseases or disorders, not by aging per se. While work is completed under the auspices of NIA, nearly all of the other campus Institutes are involved where findings are within their disciplines. Another long-term research arena is work on slow viruses where diseases become evident only after years of latency.

- ***Quick Response Investigations***

At NIH, intramural researchers need only the approval of Institute directors to proceed with new investigations. They can respond quickly to new research opportunities and public health concerns and

emergencies. Intermediate results in work can indicate an entirely new direction for the work. Results from other research on the campus can be immediately tied to ongoing research, again rapidly changing the course of work.

For example, an NIH investigative team was working on the human leukemia virus. When the concerns about an AIDS epidemic exploded on the American consciousness, they suspected a related retrovirus. Within days, they switched to searching for the virus.

- ***Low Potential Yield Investigations***

Without the pressure for immediate results, NIH researchers are free to pursue investigations with a comparatively low potential yield for immediate results. Younger investigators, in particular, benefit. They are permitted to pursue research off the beaten path, or research that is not glamorous or popular. NIH also permits them to investigate new ideas and new theories. Those studies materially contribute to the broad base of the pyramid of biomedical research. These programs have resulted in numerous Nobel Prize winning discoveries and investigations including Nirenberg's unraveling of the genetic code, and Gajdusek's discovery of an entirely new class of slow viruses that cause serious neurological diseases. Nirenberg had never worked in the field of protein synthesis and would in all likelihood not have qualified for a grant.

- ***Verification - Refutation Studies***

Intellectual excitement and honor associated with discovering the causes of diseases and disorders or their cures is far greater than proving or disproving the findings of others. Publication of findings about the causes or potential cures of diseases in scientific journals does not necessarily mean that the research methods or conclusions are accepted as correct. A critical contribution of the intramural research program is verification - refutation research of claims made by others, particularly with respect to clinical trials. Trials can be arduous, time consuming, and expensive. Few other institutions have the fiscal means and the collective expertise of the NIH Bethesda research staff to support refutational research. These studies frequently involve two or more Institutes working in the Clinical Center.

- ***Disinterested Advice and Opinions***

Intramural NIH scientists are the major U.S. source of disinterested advice on biomedical research with an unparalleled public credibility. Intramural scientists and physicians make important contributions to NIH Consensus Development Conferences, which are open to the public. These conferences have become preeminent forums for resolution of scientific arguments about what is or is not effective in current medical practice. The public relies on NIH to give disinterested advice and opinions about research in the private sector.

3.2.3 Administrative-Institute-Center Functional Relationships

The Bethesda campus is the administrative center and headquarters for NIH research activities. The Office of the Director is located here. All Institutes and Centers (IC) have a respective IC Office of the Director that provides immediate access to the NIH Director.

The directorate offices are responsible for the overall scientific direction and administration of NIH. At the directorate level, decisions reflecting development of coordinated strategies within annual budgets must be made. Individual Institute directorates define program initiatives and funding decisions. NIH, however, is involved in hard science at the laboratory bench. Its administrative procedures must conform to those of the scientific establishment in general. Two administrative procedures used in general science

greatly influence those at NIH. They are the method of funding both intramural and extramural research and the scientific peer review of research.

These procedural requirements inextricably intertwine the administration of individual Institutes with one another, and tie administration to the scientific or technical staff. In dozens of interviews, IC directors emphasized the importance of their close proximity to one another in running their extramural programs.

When mandates or requirements for biomedical research first reach NIH, the routes taken to find solutions are not necessarily self-evident. Institute directors along with laboratory and research directors and other appropriate scientific personnel make decisions on whether to complete work intramurally or extramurally. If intramurally, decisions are made on which Institutes will do which work. Several research programs or initiatives may be begun in parallel.

When an extramural research need is identified at NIH, and private outside researchers or facilities are used, the work is handled by grant, contract, or agreement. This research activity may be routine, may not require Clinical Center facilities, may be large volume work, or work done by outside specialists.

NIH is different from most other federal agencies, however, in using grants, contracts and cooperative agreements to fund the extramural research program. Each year NIH receives thousands of requests for extramural biomedical research grants from universities, research hospitals and research centers. In Fiscal Year 2000, NIH made over 35,000 grant awards for biomedical research and training. In contrast to other federal government agencies which receive specific proposals to complete specific work requested by the agency, grant applications often cover any potential research that the applicant feels worthy of study. Proposals may be related to ongoing research at NIH, may be directed to independent research by outside specialists, or may even be serendipitous, pursuing an idea uncovered in the course of ongoing research.

The Office of Extramural Research (OER) is the gateway for all extramural research and training programs. It operates several computer-based data systems for managing, tracking, and evaluating research. Since 1946, NIH has employed a two-tier peer review system to ensure that the best science is funded. The first level of peer review is performed three times each year by more than 150 Initial Review Groups (IRG) that assess applications for scientific and technical merit. The IRG members include respected and knowledgeable extramural scientists. Their assessments of the grant requests are compiled by OER in a summary statement that critiques the proposed work and gives it a priority score and percentile ranking. In all, about 2,400 individual reviewers participate in the program.

Once the technical applications are reviewed by the IRG, national advisory councils serving the Institutes and Centers (a second review tier) review the applications for program relevance and make recommendations to the Institute and Center Directors. The administrative directorate, in consultation with NIH extramural program staff, makes funding decisions that maximize scientific value for given budget allocations. Discussions occur between Institutes to avoid duplication of work and to coordinate extramural programs, both with intramural studies and among the different Institute extramural programs.

On the average, only about 20% of all research fund requests are funded. Yet, consistently, about 85% of all NIH research expenditures are allocated to the extramural contract and grant research programs.

3.2.4 Training of Biomedical Researchers

It is no coincidence that much of the top award winning and most cited science is done in a few dozen institutions around the world. There is a triad of relationships between facilities, personnel, and the

research performed. High quality facilities that permit research at the cutting edge of scientific investigation attract world class talent. At some point, there is sufficient talent and quality of research to draw other first class scientists into the organization. This is a high priority for NIH.

The critical mass of tenured senior scientists and clinical physicians, along with the largest combination of clinical facilities and laboratories in the world, make the NIH Bethesda campus unparalleled as an education center and training ground for young researchers. About half of all researchers on the campus are post doctorate fellows paid by NIH, or Special Volunteers and Guest Researchers.

Most of these researchers work at NIH for two or three years and then deploy to universities and medical research centers worldwide. NIH is the primary training center for third world researchers who will be leaders in developing their countries' national health programs. The intramural research program has trained more than 50,000 M.D.'s and Ph.D.'s, particularly M.D.'s who are clinical physicians bridging the gap between science and bedside care. Of all M.D.'s trained in the program between 1975 and 1985, 90% remain in research and teaching. In large part, the U.S. biotechnology industry has been spawned by program graduates. NIH alumni have cloned NIH intramural programs throughout the academic and industrial world.

The quality of the training at NIH is exemplary. As of 1995, five NIH staff scientists had received the Nobel Prize and 14 Nobel Laureates worked at one time or another in the intramural program. More significantly, 98 other researchers had earned the Nobel Prize in physics, chemistry, and medicine for work associated with the NIH extramural program. A total of 109 members of the National Academy of Sciences have worked in the intramural program. NIH intramural program scientists have won 34 Lasker Awards. In a 1991 analysis of scientific productivity, NIH ranked near the top not only in quantity, as measured by the number of papers accepted for publication, but also in quality, as measured by the number of citations per paper by other researchers, particularly in the categories of AIDS, gene therapy, and cardiovascular and respiratory medicine research. More than 10% of the world's most frequently cited biomedical research scientists, including four of the top 10, work at NIH. Although NIH intramural researchers receive only 5% of the nation's biomedical research budget, they are responsible for 26% of the most influential research based on frequency of citation of work by others.

Maintenance of research staff and top quality facilities is essential if the U.S. is to retain its competitive edge in biomedical research, which in turn is due in part to the existing intramural program. The number of research physicians is declining nationwide. This is due to economics; medical school tuition is prohibitive. Young physicians are driven to practice to pay off enormous education debts. Even if interested in research or teaching, they frequently cannot risk further indebtedness. Moreover, many private research institutions may be unwilling to, or cannot afford to, take a chance on hiring young physicians potentially rich in talent, but limited in clinical or laboratory experience. The NIH intramural program offers an opportunity to overcome these difficulties.

3.2.5 Essential and Specialized Support

A complex web of organizations that provide essential support services to the Clinical Center and Institutes is also on campus. Full exposition of the intricate administrative and functional relationships between all support organizations and the Clinical Center and Institutes is beyond the scope of this EIS. The following is a partial listing or extract of the many support functions provided on campus.

- Training of researchers in laboratory safety.
- Training of employees in fire protection and evacuation.
- Police and fire protection.

- Emergency response to incidents with special expertise in biomedical research and hospital conditions.
- Planning, engineering, architectural, and construction services for new facilities and those undergoing alteration.
- Renovation and modification of research and hospital spaces. On the average, over 500 hundred such projects are underway at any given time.
- Supply of over 6,300 laboratory and hospital items such as equipment; furnishings; chemicals, biological, and radioactive materials, and consumable materials.
- Design and fabrication of research and hospital equipment in electronics, machine, carpentry, plastics, and glass shop that are not available as off the shelf items.
- Maintenance of repositories of viruses, bacteria, molds, yeasts, fungi, and healthy and diseased tissue for study and replication of experiments.
- Maintenance and care of animals used in research.
- Supply of steam and chilled water for heating and cooling buildings and use at the laboratory bench.
- Maintenance and operation of campus utilities such as water, electric power, communications, natural gas, and sanitary waste.
- Management and inspection of facilities for compliance to applicable laws, regulations, and NIH Bethesda site permits.
- Management, marshalling, treatment, and disposal of general, chemical, radioactive, and hazardous waste.

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Section Four

Alternatives Including the Proposed Action

4.1 INTRODUCTION

The Master Plan has progressively evolved in a continuous planning process from initial Institute and Center (IC) estimates of NIH Bethesda personnel and space needs made in 1993, through development of the 1995 Master Plan and its 1999 Northwest Sector Amendment, and subsequently, the NIH Bethesda Master Plan 2003 Update. The initial step was identification of site constraints and conditions. Site planning principles were generated to guide the planning process and eventual site development. Subsequent steps in 1993 consisted of the advancement of six general concepts or schemes as a framework for planning, and the selection and refinement of two of these concepts, the “Olmstedian” and “Quad-Mall” schemes, as preliminary alternatives. The best features of these preliminary alternatives were then merged or combined to produce the 1993 Draft Master Plan Alternative based on an ultimate campus population of 22,900 based on extensive interviews with Institute directors who made estimates of future program requirements.

After publication of the 1993 Draft Master Plan, two broad shifts in planning premises occurred. The first involved the general character and operations of the federal government. Increased emphasis was placed on reducing expenditures and downsizing facilities and personnel. In the 1995 Master Plan, within this context, long term or twenty year campus population projections were therefore reduced from the 22,900 given in the 1993 Draft Master Plan to about 18,000, or 10 percent over the 1993 employee population of 16,325. The 1995 Master Plan was based on a decline the campus population to about 15,000 by 2000, when moderate growth would begin. The planned 2005 population was about 16,000, still less than in 1993.

The second principal shift in planning premises occurred in 1994. At the request of Congress, an External Advisory Committee reviewed the NIH intramural research program. The committee recommended changes in research policies, procedures, and most importantly, Clinical Center renewal proposals in the downsizing framework. Rather than replace the entire Clinical Center complex in Building 10 with a new 3,000,000 gross square foot (gsf) facility as proposed in 1993, the 1995 Master Plan was based on a new or replacement 600,000 gsf Clinical Center inpatient hospital with 250,000 gsf of associated clinical research laboratories as recommended by the committee. The facility would be located at or adjacent to the existing Clinical Center because of operational exigencies. The remainder of the Clinical Center facilities in Building 10 would be renovated rather than replaced.

While the 1995 Master Plan reflected these changes, it still rested on site constraints and conditions and planning principles developed in 1993. The 1995 Master Plan underwent a rigorous review by neighborhood citizen associations, the general public, and jurisdictional government agencies.

Subsequently, it was determined during the design phase for the Clinical Center hospital replacement, the Mark Hatfield Clinical Center, that Center Drive would have to be realigned in the area to the north of Building 10. The road realignment, in turn, would require the shifting of potential facilities proposed for the northwest sector of the campus in the 1995 Master Plan. These changes were covered in a 1999 Amendment to the 1995 Master Plan.

Significant changes in the anticipated direction of biomedical research have occurred politically and scientifically since 1995. Funding for NIH biomedical research has increased rather than declined. The rate of growth in funding doubled from an average historic level of about five percent per year to ten percent per year between Fiscal Years 1997 and 2003, although the last two budgets have been more modest. Congress has established two new Institutes and four new Centers since 1995 (see Section 2.2.2 and 2.2.3). On the scientific side, accelerated developments in DNA, human genome, and genetic research have expanded the horizon or opened new avenues for research in nearly every other biomedical research discipline.

The following sections trace project development chronologically. The 1995 Master Plan, and all related preliminary alternatives developed for the 1995 plan, are no longer under consideration by NIH, although they form the basis or foundation for the Master Plan 2003 Update. They are briefly summarized in the following. More detail is given for the Master Plan 2003 Update Alternative and the No Action Alternative in Section 4.6. The Master Plan 2003 Update is the preferred alternative.

4.2 SITE PLANNING PRINCIPLES

A set of planning principles was established for guidance in subsequent detailed Master Plan project development. They are the first step toward conceptual planning, and represent broad design objectives which can be applied to any proposed features and alternatives that are developed in the planning process. Application of the principles in the planning process reveals conflicts that arise among them. One principle is not adamantly or strictly held at the total sacrifice of others. It is the purpose of a Master Plan to find the best or optimum balance among the set of principles as a whole.

The major planning principles for the Bethesda campus are:

Campus Structure

- Acknowledge the four anchor groups of buildings that will remain through the planning period and incorporate them into the Master Plan. They are:
 1. Buildings 1 through 5 in the historic area of the campus
 2. Building 6 and Building 31 in the northeast sector.
 3. Research buildings 29A, 29B, 37, 40, and 49 on the west side of the campus.
 4. Buildings 41, 45 and 38, 38A (the National Library of Medicine) in the southeast sector.
- Concentrate and intensify development in the campus core area (See Figure 2-3) to improve campus function and minimize impacts on surrounding neighborhoods.
- Respect and incorporate buildings eligible for the National Register of Historic Places into the overall campus structure.
- Respect the existing orthogonal or cardinal axis grid of buildings and roads.
- Relate existing and proposed future building groups into an identifiable hierarchy.
- Create open spaces in the interior of the campus to give definition to building groups and clusters and enhance the esthetic quality of this area.
- Retain the landscape character of the site perimeter and respect existing topography.

Landscape/Natural Features

- Respect the designated buffer zone, around the periphery of the site. Reinforce landscaped screen buffer adjacent to Edgewood/Glenwood. Retain less densely planted lawn areas allowing views into the site along Rockville Pike and Old Georgetown Road.
- Respect and enhance the esthetics of the stream valleys.
- Incorporate topography into site design to minimize development impacts.
- Emphasize two existing distinct landscaping zones - a landscape dominant zone with predominantly "natural" landscaping around the periphery of the campus, and the more urban building dominant zone in the core area where "formal" landscaping occurs.
- Preserve, reinforce, and enhance the distinctive aesthetic and natural character of the four corners of the site: the "Forest" in the northwest corner; the "Stream" in the northeast corner; the "Lawn" in the southeast corner; and the "Park" in the southwest corner.
- Create defined open space within the interior of the campus. Locate and utilize these open spaces to link various areas of the campus together and create a pedestrian friendly environment.

Development Proximity to Metro

- Encourage public transit use by locating new development within walking distance the Metrorail/Metrobus facility to the extent feasible.
- Public oriented amenities should be located close to the Metro station.

Development Density Zones and Community Buffers

- Create a series of development density zones for the site, with the highest density being located around the campus core and the lowest density toward the campus perimeter and surrounding neighborhoods.
- Maintain the open space buffers and views along Rockville Pike and Old Georgetown Road, consistent with security requirements.
- Enhance screening of neighborhoods along the north and south sides of the site.

Functional Relationships

- Recognize the Clinical Center Complex as the functional heart of the campus.
- Cluster administrative functions along the more "public" east side of the campus.
- Primarily locate laboratory and research uses toward the core of the campus with proximity to the Clinical Center.
- Maintain the northwest corner of the site for low-density residential and special use functions.
- Provide a secure and supportive environment for campus activities.

Clinical Center Renewal Development

- Retain and revitalize the Magnuson Clinical Center as a major campus organizational feature.
- The existing core of Building 10 will be retained and should remain the highest building mass within the new Hatfield Clinical Center composition.
- The clinical hospital and laboratory expansion will occur to the north and west of the existing Building 10. Future potential laboratory expansion will be located immediately to the south of the existing facility.
- New construction at the Clinical Center should respond to the strong axial nature of the existing building form.
- Due to the large bulk of the Clinical Center, appropriately scaled open spaces should be created around the building and the relative sense of openness of the surrounding landscape should be preserved.
- The "public" face of the Clinical Center and the primary public entry should be located on the north side of the complex, addressing the Loop Road or Center Drive. A primary "campus" or research entry for pedestrians should be located on the south side.
- A clear pedestrian access path should be accommodated through the building.
- Continue to locate service access on the east and west sides of the complex, away from the primary entries and pedestrian circulation paths.

Public Access and Orientation

- Reinforce the Rockville Pike and Old Georgetown Road corridors as the primary public "address" for the site.
- Reinforce campus organization through the creation of a "campus loop", which will become an orientating device for employees and visitors, and provide clear access to all areas of the site.
- Align the "campus loop" with existing campus circulation paths where possible. Design new

- portions so as to minimize impacts on neighboring communities.
- Designate the "campus loop" as the primary internal campus public "address" for NIH buildings. Reinforce existing buildings/groups which face the loop and orient new buildings/groups toward the loop.
- Take greater advantage of access to the site by Metrorail through enhancement of paths between Metro and the core of the campus, and creation of internal campus pedestrian and bicycle connections to the north and south areas of the campus.

Parking

- Reduce surface parking located in the perimeter buffers where and when feasible.
- Reduce surface parking on the campus to the extent feasible to create a more pedestrian friendly environment and reduce stormwater runoff.
- Concentrate parking in existing or new parking "reservoirs" which are: a) conveniently accessed from major entries or the campus loop; b) located away from the Metrorail station; c) separated and buffered from residential neighborhoods.

4.3 THE 1993 DRAFT MASTER PLAN

4.3.1 Preliminary Concepts

The 1993 Draft Master Plan was presented as the proposed action alternative in the NIH Bethesda Campus Master Plan, Draft Environmental Impact Statement in October, 1993. It was predicated on complete replacement of the existing Clinical Center Complex as recommended by studies completed by the U.S. Army Corps of Engineers. The replacement Clinical Center was to be located in the square north of Building 11, since this was the only area of sufficient size within the campus that could accommodate the approximately 3.0 million gross square feet (gsf) of floor area that was estimated to be needed.

The 1993 Draft Master Plan used an NIH employee population of 22,900 by 2013 on the Bethesda campus as a basis for development of the plan. The planned future employee population associated with the 1993 Draft Master Plan would have led to an attendant growth in space requirements. Space requirements amounted to an estimated 11,300,000 gsf by the year 2013. If the 1993 Draft Master Plan were fully implemented, about half of the existing square footage would have been replaced or renovated over the course of the planning period. Much of this was attributable to the proposed total Clinical Center replacement.

In the initial phase of planning, it was evident that NIH possessed many of the positive physical and organizational characteristics of an academic, research, or university environment. A college or university "campus" is an American concept that provides a model for placing buildings devoted to the pursuit of knowledge in a hierarchal setting. Using layouts or plans from five American universities that were known to function well as a genesis for ideas and reference points, five concepts for development of NIH were generated.

Subsequently, a sixth concept, the Quad-Mall scheme, was added to the five original concepts by combining the best features of the Quad and Mall concepts. Two concepts, the Olmstedian and Quad-Mall schemes, were selected for further refinement as the "Park" and "Quad Campus" preliminary alternatives for the 1993 Master Plan. Each was adapted to existing conditions and adjusted to match anticipated NIH space requirements by type of use. All of the initial concepts were evaluated for functional relationships, community impacts, transportation needs and function, and campus quality. The

best components of each were incorporated into the two selected preliminary alternatives, which were then renamed as the "Quad Campus" and the "Park".

4.3.2 Principal Features

The 1993 Draft Master Plan Alternative was a refinement and a further development of the Quad Campus Preliminary Alternative. The principal features of the 1993 Draft Master Plan Alternative were:

4.3.2.1 Clinical Center Replacement

The focal point and fundamental premise of the 1993 Draft Master Plan was a new Clinical Center Complex that would replace the 2,385,000 gsf Building 10 complex. The new center would have been located on Center Drive to the west of the Metrorail and bus station with its front facing Rockville Pike. It would have had about 3,000,000 gsf of floor space exclusive of parking. About 1,400,000 gsf of this area would have been for clinical research laboratories, and about 1,300,000 gsf would have been devoted to patient care, but the number of patient beds was expected to be reduced to about 450. The remaining space, about 300,000 gsf, would have been for offices, support, and public spaces. The Clinical Center would continue to house about 6,500 employees as does the Building 10 complex. The larger square footage would provide more laboratory space, an upgrade in infrastructure and utility support systems, and correction of safety issues. The new Clinical Center would have been constructed between 1998 and 2004.

4.3.2.2 Central Heating and Cooling Plant Consolidation

The 1993 Draft Master Plan Alternative incorporated the 1992 Master Utility Plan improvement recommendations for the central heating and cooling plants in Buildings 11 and 34. Design of the new Clinical Center Complex would have been integrated with the expansion of the power plant in Building 11. In particular, it was proposed to combine all boiler stacks into a single stack which would be integrated within Clinical Center structures.

The Master Utility Plan proposed consolidation of power plant functions in Building 11, and the decommissioning and demolition of Building 34, which would occur when the Clinical Center replacement was in operation and Building 10 was decommissioned. The Master Utility Plan also proposed adding two new boilers and renovation and upgrade of four existing boilers. A cogeneration system could be added as an alternative to a sixth boiler. Existing Chillers 1 through 15 would be replaced by twelve new chillers of larger unit capacity.

4.3.2.3 Building 21

In the 1993 Draft Master Plan, a proposed replacement for the support service functions, now in Building 21, was projected as a three or five story building located on the south side of Building 11. The Building 21 replacement would have screened areas to the south from the lower levels of the power plant, and defined the north side of the south laboratory quad. The building would have functioned as an internal campus distribution and collection point for waste materials. Its adjacency to the Clinical Center Complex replacement would have minimized internal campus transport of these materials.

4.3.2.4 Research and Animal Care

The 1993 Draft Master Plan proposed a net increase of about 1,470,000 net sf of research space including that in the Clinical Center replacement complex. Laboratories and research facilities were set in clusters around malls and quads on the north, west, and south sides of the Clinical Center in proximity to it.

In the proposed western cluster, new research buildings would fill in gaps between an existing cluster of laboratories defining an east-west quad. Two new buildings, combined with those proposed in the north cluster and laboratories or research facilities on the south side of Building 10, defined a large 1,100 foot by 300 foot mall with the long axis running north-south.

A southern cluster of research buildings formed an additional quad. Building mass and heights in this quad would have been progressively smaller from east to west. The buildings on the east side of the quad would front to Rockville Pike and be 6 to 8 stories in height. On the west side, the buildings would have had 3-5 stories. A new animal care building which reoriented facilities from the horizontal single floor configuration in the existing Building 14/28 complex to a vertically oriented structure with a small floor plate would anchor the south side of the quad. Five to six stories extended above ground level.

4.3.2.5 Office and Support

Office and support facilities proposed in the 1993 Draft Master Plan were arranged over a large L-shaped area extending from Building 31 in the north, to the National Library of Medicine at the apex of the "L" to the south, and then westward along the southern periphery of the campus to the inside of the buffer area. Office and support includes administration, campus engineering and maintenance, and storage facilities supporting the Clinical Center and laboratories. The majority of office and support facilities were along the Rockville Pike leg of the "L".

New administration buildings were proposed to the east of Building 31, and on the east side of the NIH Stream north of South Drive on the site of existing Building 21, which would be demolished. Other support offices, receiving and warehouse functions, and replacements for Buildings 12 and 13 were integrated with parking structures on the south side of the campus in two new support service buildings.

These two new service buildings fronted proposed new parking structures, and would step down in height as one progressed toward the residential neighborhoods to the west. Ground elevations in this area, and in the research quadrant to the north are about 315 feet. Ground elevations at the southern NIH property line are 340 feet or higher along an arc extending from south of these support buildings to the NIH Stream valley at the end of Roosevelt Street, shielding the bulk of the building mass and Loop Road traffic from neighborhoods to the south and west.

The 1993 plan proposed a new fire station sited on the north side of Center Drive to the east of Old Georgetown Road to replace the station on the east side of the power plant.

4.3.2.6 Amenities

The chief physical amenities proposed in the 1993 Draft Master Plan Alternative included:

- Child care centers for NIH employee children. The four recommended locations were the Wilson family house (not Tree Tops) with its garage and storage sheds converted to play areas; a site just to the south of the Naval Medical station; expanded facilities in former Building 35; and an expansion of the existing child care facility in the southwest corner of the site.
- A three or four story campus building that would contain food service, recreation, retail, informal meeting places, and small conference rooms located at the present site of Building 34.

4.3.2.7 Roads/Parking/Pedestrian

In the 1993 Draft Master Plan, Center Drive would be widened from two to four lanes and serve as the primary access route through the campus directing traffic to the "front door" arc from Wilson Drive to the

Center Drive/Rockville Pike intersection. A relocated extension of Lincoln or Convent Drive would have completed a loop around the core area of the campus. Walks would be widened in the core area to accommodate emergency or service access, but general vehicular use within the core area would be prohibited. All existing campus entrances were to remain except East Drive on West Cedar Lane.

Surface parking would have been minimized throughout much of the campus. Areas around the perimeter of the campus now covered by surface parking were returned to natural conditions. Vehicles would park in multiple level parking structures (MLPs) distributed around the campus on the periphery of the loop road system. New MLPs were integrated into the topography to minimize impacts. Additional parking could be located underground. Underground parking was also located below the Clinical Center replacement, the new mall to the west of the Center, and a new laboratory complex that would have replaced the existing Building 10 complex.

Pedestrian and transit use was emphasized. Nearly half of the projected NIH employee population would have worked in buildings within 1,200 feet of the Naval Medical station. Connected malls and quads, and a covered walkway between the station and new Clinical Center, encouraged pedestrian use.

4.4 THE 1995 MASTER PLAN

The 1995 Master Plan was based on, and consistent with, the findings and recommendations of the External Advisory Committee, which reviewed and evaluated the intramural research program, and the Clinical Center facilities this program would need to function efficaciously. The plan placed greater emphasis on upgrading intramural research facilities than the 1993 plan, and lesser emphasis on consolidation of Extramural Research Program administration on the campus. Taking the Committee report projections into account, NIH management was reinterviewed to obtain an estimate of potential future campus population. Results indicated a decrease in anticipated population over the short term due to current and projected proposals to downsize government, but a long term growth of about 10 percent over the 1993 population levels. Much of the campus population growth was attributable to a consolidation of intramural research staff on the campus from off-site locations.

Under the 1995 Master Plan Alternative, it was estimated that NIH employees would be distributed in Montgomery County in the future as follows:

<u>Year</u>	<u>NIH Bethesda Campus</u>	<u>NIH Animal Center</u>	<u>Other Montgomery County</u>	<u>Total NIH Montgomery County</u>
1995	16,325	132	4,983	21,441
2000	15,150	114	3,838	19,078
2015	18,025	114	3,510	21,650

Programming for the 1995 Master Plan estimated a year 2015 space requirement of approximately ten million gross square feet (gsf), or 43 percent more than the 7 million gsf existing in 1995. Most of the increase was attributable to growth in laboratory space. About 2.3 million gsf of laboratories would be added to reach the goal of 300 net square feet per researcher in laboratories, despite only a small increase in the projected numbers of NIH intramural researchers. The Clinical Center renewal hospital accounted for much of the remaining growth. Most of the growth in laboratory space would occur after 2010. At ultimate buildout, about 4.7 million gsf of building space would be new or renovated space, and about 5.3 million gsf would be existing space to remain in use.

Three concept studies (A, B and C) were developed to determine the potential ramifications of a Clinical Center Complex renewal instead of a replacement (Final Environmental Impact Statement for the 1995 NIH Bethesda Campus Master Plan, Vol. 1 of 2, NIH, 1996). The studies were meant to test the reactions of NIH and citizen groups to different possible development scenarios for the Clinical Center Complex. The studies indicated potential trade-offs among the planning principles developed in Section 4.2, and were a planning mechanism in that the best features of each concept could be incorporated and consolidated into the Master Plan.

All three studies were premised on NIH Bethesda growth from 16,325 to about 18,000 employees, a new Clinical Center hospital north of Building 10, and that over the next 20 years, NIH would need an additional 2.3 million gsf of laboratory space, primarily to decompress existing facilities and bring laboratory space per researcher up to average national standards. About 10 to 12 new buildings would be necessary to accommodate this laboratory space expansion. The studies premised that NIH would also need about 70,000 gsf of new office space to decompress administration areas, two new child care centers, and a new fire station. Each concept retained the internal campus Loop Road developed in the 1993 Master Plan Alternative for improvement of campus organization and circulation.

Consistent with the planning principles outlined in Section 4.2, the studies proposed new development concentrated in the campus core area to the extent feasible, drawing development away from the buffer zone and site periphery. Most of the core area is already occupied, and few sites are available for unfettered development. The squares to the north and south of Building 11 currently have comparatively low density development. The Building 12 and 13 group is generally two to three stories above the surrounding ground level. With the exception of a small administrative area on the northwest corner, Buildings 14 and 28, the animal care facilities are single story structures occupying a large ground or surface area. If high density replacement facilities are to be accommodated and intensified in the core area away from the site perimeter, these low density facilities must be relocated.

The 1995 Master Plan adopted and refined the best features of the concept studies. It is described in detail in the 1995 Master Plan, NIH Main Campus, NIH, 1995. The Master Plan set forth NIH program requirements and planning goals and objectives. It defined site planning principles and concepts, existing features, environmental and infrastructure constraints, and the community context. Guidance is given on proposed campus land use, building sites, amenities, road and site improvements, vehicle and pedestrian circulation, and service access. Possible phasing of construction or eventual implementation of the plan was given. The Illustrative Plan for the 1995 Master Plan Alternative is shown in Figure 4-1. The major features of the 1995 Master Plan Alternative are summarized in the following sections.

4.4.1 Clinical Center Renewal

The total floor area in the Building 10 complex is about 2,273,000 gsf exclusive of parking. The original Clinical Center, which was dedicated in 1953, includes the clinical inpatient hospital, and associated clinical laboratories and research space. It accounts for 1,245,000 gsf of the total floor area. Many additions to this original core building were built over the intervening years. The largest of these is the Ambulatory Care Research Facility (ACRF), which added nearly one million gsf of space devoted to outpatient clinical care and research in 1980.

A three step program for renewal of the Clinical Center Complex was proposed and is in the process of being implemented, i.e.,

- A. Essential Maintenance and Safety (EMS) Program.
- B. New inpatient hospital and clinical laboratories.
- C. Renovation and rehabilitation of Clinical Center core built in 1952.

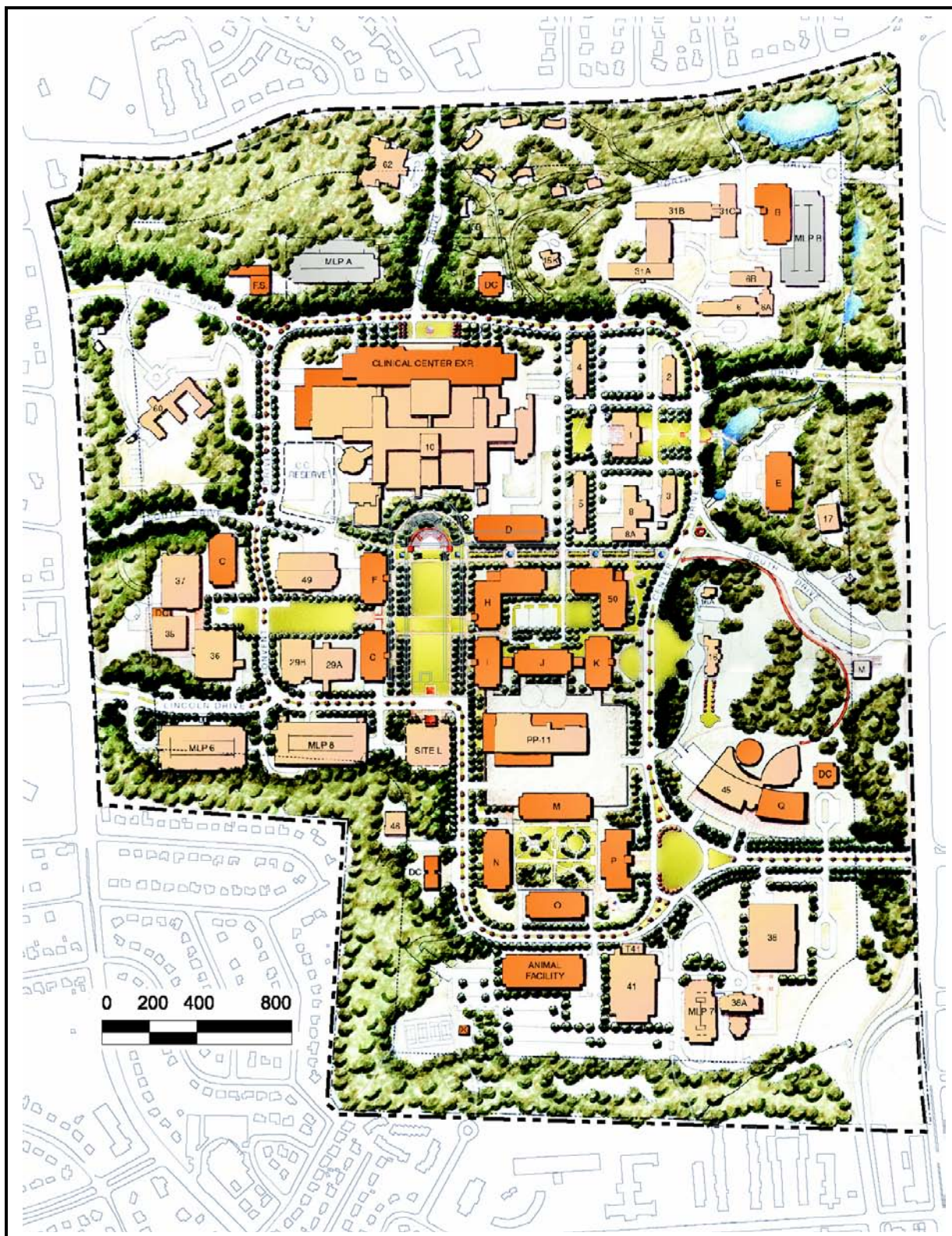


FIGURE 4-1 THE 1995 ILLUSTRATIVE MASTER PLAN.

The intent of the Essential Maintenance and Safety Program was to maintain a healthy and safe environment in the complex until the original core renovation could be completed. This step has been completed.

In the second step, a new state-of-the-art, 240-bed inpatient hospital, associated clinical research, and support functions would be built. A complex lattice of operational and organizational interrelationships exists between the hospital, laboratory, and support functions within the Clinical Center Complex. Construction of the Clinical Center Renewal Hospital was proposed on the north and, if needed, west sides of the existing complex.

The new hospital would have about 600,000 gsf of floor area, and related research space would occupy 250,000 gsf. Only about half of the clinical research facilities would move into the new facility with the remainder remaining in Building 10. Estimated overall space allocated for the facility was the minimum necessary to provide safe and efficient operations as foreseeable by scientific and health care specialists at the time. New space would be flexible and adaptable to meet a wide variety of unexpected requirements, particularly in terms of capacity of supporting infrastructure and utilities.

Upon completion of the new Clinical Research Center Hospital, personnel and functions would be relocated or transferred to the new facility. The vacancies created in the old existing space would permit implementation of the third step in the renewal process, complete renovation and modernization of Building 10. This would be done in phases with the Essential Maintenance and Safety Program continuing throughout the process until all spaces were renewed.

4.4.2 Central Heating and Cooling Plant Consolidation

The 1995 Draft Master Plan Alternative continued to use the Master Utility Plan proposals prepared in 1992 for modernization and expansion of the central heating and cooling plant. Many of the proposed improvements are needed to meet current campus demands, refurbish equipment, and increase energy efficiency in production of steam and chilled water.

As in the 1993 Draft Master Plan, Building 11 would be extended about 60 feet to the south, and 100 feet to the east to accommodate new boilers and chillers. An underground expansion would also be built on the west side for an underground equipment room and above ground offices, and employee spaces. Two new boilers were to be added, the four existing boilers would be refurbished, and flue gas recirculation would be installed for stack air emission control. Existing Chillers 1 through 15 in Buildings 11 and 34 would be replaced by installation of 12 new larger unit chillers over the next 20 years in Building 11.

The 1992 Master Utility Plan also recommended the following:

- The merger of the individual stacks for Boilers 1 through 5 into one combined stack. The new stack height would be higher to improve emission aerodynamics.
- Backup fuel tanks would be relocated to the north side of Building 11.
- Ice storage, located in a sublevel of the Building 11 expansion, would be used as a chilled water storage option.

All chilled water production facilities would be consolidated in Building 11, and Building 34 would be decommissioned and razed.

The first two recommendations have been implemented. An ice storage system was designed as part of the Building 11, Phase I, expansion, but it was not built when bedrock was encountered at a more shallow depth than expected during construction. It remains a potential option on an individual building basis.

Consolidation of chillers in Building 11 is underway, but this process will not be complete until after 2010.

4.4.3 Research and Animal Care

The 1995 Master Plan identified 12 to 14 campus sites as potential locations for eventual construction of up to 2.3 million gsf of laboratory space. Most of the new space would be for decompression of existing laboratory space, increasing the space per researcher to approximately the current national average. In general, phasing of construction at each site, and assignment of space to a specific Institute was not defined, providing maximum development flexibility.

Potential laboratory or research building sites were concentrated in the campus core area. Three research oriented buildings, including Building 50, were grouped in a cluster to the north of the central heating and cooling plant in Building 11 (East Quad), while three others combined with a new service/shop building to form a new quadrangle on the south side of Building 11 (South Quad). The potential research facility site on the west side of the south quadrangle, new site N, was shifted about 150 feet to the east, further away from Glenwood than proposed in the 1993 Draft Master Plan. Laboratory Buildings 29 and 30 would be replaced by Building G, and two additional new research building sites were identified within the existing groups of laboratories on the west side of the campus (West Quad). New research building construction would define an open space mall (Central Mall) extending from the Clinical Center Complex in the north to Building 34 to the south.

Two sites were available for development in the latter phases of the planning period. The first, Site A, was north of the Clinical Center Complex. The site could be used for residences or special functions related to the Clinical Center, where immediate proximity or adjacency was not needed. The other, Site E, was located in the NIH Stream valley, replacing Building 21. Site availability, however, would be contingent on relocation of Building 21 along with its activities. It was anticipated that Site E would be among the last sites to be developed within the plan.

Relocation and replacement of the existing animal care facilities in Buildings 14 and 28 is a key element in initiating the process of concentrating NIH facilities in the core area of the campus. Buildings 14 and 28 have a sprawling footprint covering a large ground area. Consolidation of facilities frees this area for subsequent development of a cluster of buildings around a quadrangle south of Building 11. The new animal facility was sited on the west side of Building 41. It would be oriented vertically, rather than horizontally, to reduce the foot print required.

4.4.4 Office and Support

Predicted growth in office and support space was reduced from the approximately one million gsf proposed in the 1993 Draft Master Plan to about 170,000 gsf. About 95,000 gsf of this office and support growth would be in the Building 2 and 3 conversions from laboratory to office buildings. The remainder of the growth would be in a new building, which could be located on the east side of Building 45, or to the east of Building 31, depending on the actual sequencing of future events.

When the Building 13 site was needed for a future development, Building 13 activities would be relocated elsewhere. Administrative offices for support activities, about 200,000 gsf, would be merged with facilities proposed for general office space. Shops, supply activities, and other non-administrative support services in Building 13 were relocated to the proposed service building on the south side of Building 11, where they were combined with Building 21 services, if that facility was relocated.

4.4.5 Amenities

Physical amenities proposed in the 1995 Draft Master Plan Alternative include:

- Designation of the Building 34 site as a potential location for a Campus Center, which would be oriented toward activities and uses for NIH employees and nearby residents. Visualized activities include conference and meeting rooms; a child care center; a fitness center; dry cleaners, concession stands, and credit union outlet. This facility is not programmed.
- New child care centers would be built on the north side of the campus near the Clinical Center. The infant care facility in Building T-46 in the southwest corner of the campus would be replaced by a larger facility at the Building 34 site. Campus child care capacity would be increased from 99 to 465.
- Large open malls and quadrangles with landscaping and street furnishings to encourage NIH employee interaction.
- Site A to the north of the Clinical Center was set aside as a potential location for residences or special functions related to the Clinical Center.
- Natural landscaped areas around the buffer periphery and along stream valleys that cross the campus.

Although no specific buildings or facilities were proposed, a zone to the north of the Clinical Center was set aside as a potential site or sites for unprogrammed buildings that could have a special function or residential use. Use would not be directly related to laboratory or clinical research, or their technical support, or office use. Examples of potential use of the zone included expansion of the residential area along West Cedar Lane, residences for visiting scientists or research fellows, expansion of Children's Inn facilities, or construction of a comparable Adult Inn or a child day care center. Facilities would be low in profile, have little or no impact, and generate little employee traffic.

4.4.6 Roads/Parking/Pedestrian

As in the 1993 Master Plan, a Loop Road was the main feature for internal campus access. It would circulate traffic around the perimeter of the core area. Its section would have different configurations at various locations depending on projected traffic volumes and whether parking and bikepaths were present. The sections range from a simple two lane roadway without bikepaths to a four lane road with median that would have a total curb to curb width of about 62 feet when bikepaths are present.

In the southwest sector, the 1995 Master Plan Loop Road was shifted to the east of the 1993 plan alignment, increasing the distance to the east side of Edgewood/Glenwood, from 300 to 400 feet. In addition, the Loop Road was routed around the north and east, rather than the south and west sides of the Building 34 site.

The 1995 Draft Master Plan continued to emphasize removal of surface parking, particularly parking in the buffer zone along the campus periphery, and its relocation to multiple level parking or MLP structures. New MLPs were proposed to the northwest of the Clinical Center Complex and in the northeast corner of the site, primarily as replacements for surface parking in these areas. One or more levels of parking could be located under the quadrangle or plaza south of Building 11.

Emphasis and encouragement of pedestrian and transit use also continued. Ten of the potential building sites in the 1995 Draft Master Plan were located within a five to eight minute walk of the Metro station entrance. Fourteen of the potential sites were within a 2,000 foot radius of the Metro station escalator.

4.5 NORTHWEST SECTOR AMENDMENT

The 1995 Master Plan recognized the potential need to relocate Center Drive on the north side of Building 10 and the Clinical Center Complex to accommodate the new Mark Hatfield Clinical Research Center hospital. Center Drive was realigned northward in the Illustrative Plan in response to this requirement. The 1995 Master Plan noted that the massing of the new building and an appropriate setback from the realigned road were important.

NIH conducted a worldwide competition for the design and construction of the new facility. The winner of the competition proposed a facility that best met operational requirements and programming criteria as well as excellence in architectural design. The proposal also had a relatively low vertical profile. In general, it was six instead of the anticipated ten stories high. This meant that a larger footprint would be needed to house the programmed floor space. Center Drive would have to be relocated further northward than anticipated and this, in turn, would affect the arrangement of potential development sites and facilities proposed for the area to the north of Building 10 in the 1995 Master Plan.

The area affected covered Building 10 and its vicinity, and the northwest sector of the campus from just east of West Drive to just south of South Drive. The necessary changes were developed and analyzed in an amendment, (Amendment to the 1995 Master Plan, NIH, 1999). Since the changes primarily involved rearrangement of proposed facilities within the area affected, there were no substantive changes in potential environment impacts in the context of the Master Plan as a whole. Potential impact changes were evaluated and discussed in Proposed Revisions to Northwest Sector of the 1995 Master Plan, Final Supplemental Environmental Impact Statement, NIH, 1999.

The 1995 Master Plan set aside a general area, Site A, on either side of West Drive as a zone for potential uses unrelated to research, clinical, technical support, or office use (see Figure 4-1). Realignment of Center Drive affected the efficacy of Site A for potential development. The resultant principal changes in the Northwest Sector Amendment were:

- Realignment of Center Drive further to the north encroaching upon Site A.
- The relocation of the MLP-A parking structure from the Site A area west of West Drive to the west side of Building 10.
- The shift of the proposed Fire Station on the north side of Center Drive about 400 feet westward.
- The relocation of the Northwest Child Care Center from the east Site A area to the 1995 Master Plan fire station site.
- Designation of the area north of Building 60, the Convent, as a potential site for an Adult Inn or Guest House. The Adult Inn was visualized as a 24-room, two story counterpart to the Children's Inn, where long term Clinical Center inpatients could be temporarily housed and gain relief from weeks or months of confinement in a hospital environment.
- A new NIH north substation on the east side of the relocated fire station.

4.6 SECURITY PROJECTS

Following the April 1995 bombing of the Alfred P. Murrah Federal Office Building in Oklahoma City, the Department of Justice was tasked with developing a "Vulnerability Assessment of Federal Facilities" which was released in June 1995. Immediately thereafter, President Clinton in a Presidential Directive, ordered all agencies to begin a security upgrade process, and in October of the same year, by Executive Order 12977, established the Interagency Security Committee to develop and ensure compliance with government-wide physical security criteria.

NIH developed its Security Assessment in response to the Presidential Directive in August 1995, but the absence of significant new physical security funding delayed action by nearly all federal agencies. In summer 2001, the DHHS Office of the Inspector General (OIG) reviewed the NIH Bethesda campus physical security and made the following recommendations:

- Improve perimeter security by installation of a perimeter fence with a limited number of controlled entry and exit points, construction of a visitors center and parking facility, and installation of additional surveillance and security features.
- Construct a centralized shipping, receiving, and storage facility.
- Improve interior building security.

The attacks of September 11, 2001 and subsequent attention to physical security needs of the federal government by the Congress and public brought new urgency and significant funding for the measures required by the DHHS.

NIH is addressing all of these recommendations which are in various states of completion. For example, the NIH either has submitted or is in the process of submitting the physical security projects to NCPC for its review. The projects include:

- A perimeter fence surrounding the entire campus with vehicular and pedestrian gates has been completed. The gates provide access for employees on foot or bicycle at 13 points around the perimeter, and for employees in vehicles at six locations plus employee vehicle egress only at one location. Employees and their vehicles are screened in various modes depending on the Alert Level issued by the Department of Homeland Security (DHS). When all perimeter security features are in place, the main access for visitors arriving by foot, transit, bicycle or vehicle will be at the Gateway Center at the Metro bus and rail station on Rockville Pike and South Drive where a visitor parking structure will be constructed. After screening, most visitors will walk or use internal shuttle service to their interior campus destinations. A secondary access for Clinical Center patients and their visitors arriving by foot, bicycle or vehicle will be West Drive on West Cedar Lane where vehicle and personal screening will occur. Visitor vehicles proceeding to the Clinical Center parking garage are and will be screened also at the entrances to the garage.
- A centralized shipping, receiving and storage facility with screening capabilities, as recommended by the DHHS OIG, has been studied for both on an off campus locations. A campus location that provides adequate space for vehicle screening, receiving and storage inside the perimeter fence, and at the same time, sufficient standoff from other occupied buildings, is not available. Acceptable off campus locations that met the same requirements, as well as intercept vehicles with far and near points of origin around the compass, also could not be found. Therefore, instead of a centralized shipping, receiving and storage facility, the NIH is planning a Commercial Vehicle Inspection Facility with a dedicated access from Rockville Pike (MD 355).
- The location of the perimeter fence, commercial vehicle inspection facility, and Gateway Visitor Center are established by security parameter and requirements. They will be implemented under both the Master Plan and No Action Alternatives.
- Interior campus and building security has been handled through appropriate measures below the scale of master planning.

4.7 ALTERNATIVES UNDER CONSIDERATION

4.7.1 Proposed Action - The Master Plan 2003 Update

The Master Plan 2003 Update continues to use the same fundamental planning goals and objectives, and site planning principles, concepts, features and constraints that were established in the 1995 Master Plan with only minor modifications. Similarly, guidance given for proposed site land use, road and site improvements, vehicle and pedestrian circulation, and interior campus service access have changed only in application to detail and not in general principles. The update is described in detail in NIH Master Plan 2003 Update, NIH, 2004. The Illustrative Plan portion of the Master Plan 2003 Update Alternative is shown in Figure 4-2. A larger scale schematic version is shown in Appendix B.

Since 1995, planning premises for the Bethesda campus have been changed in three fundamental ways: budget, pace of development, and security.

- **NIH Budget**

The NIH budget historically grew by about five to ten percent from year to year. However, Congress doubled the NIH budget between FY 1998 and FY 2003 from \$13.6 billion in to \$26.8 billion. Funds have been directed not only to more across the board biomedical research, but also to specifically mandated facilities such as the Neuroscience and Vaccine Research Centers, two new Institutes and four new Centers, and dynamically expanding research fields such as genetics.

- **Pace of Development**

As a consequence, the pace of development on the campus has accelerated in terms of both facilities and personnel. Over the last three years, five buildings have been built, and seven others are currently in the design or construction stages. The campus population, expected to grow slowly to 18,000 by 2015 in the 1995 Master Plan, has already increased from 16,325 in 1995 to 17,511 in 2003.

- **Security Requirements**

The change from an open campus prior to September 11, 2001, to one with a perimeter security fence and controlled of pedestrian and vehicle access.

4.7.1.1 Campus Population

The NIH Bethesda campus employee population undergoes continual change. For planning and analytical purposes, the existing or 2003 campus employee population has been set at 17,511 as established in the annual NIH campus employee census. An additional 8,360 NIH employees work elsewhere at about 30 leased locations in lower Montgomery County. Most of these sites are concentrated at the Rock Spring Office park near Montgomery Mall, and in the I-270/MD Route 355 corridor between Bethesda and Gaithersburg. The above off campus figure does not include the NIH employees, about 115, who work at the NIH Animal Center near Poolesville in western Montgomery County, nor other regional personnel at NIH facilities in Baltimore and Frederick, Maryland.

Estimates of future functional, personnel, and space needs form a framework for the Master Plan. These estimates were obtained through a programming process. Knowledgeable personnel in the 27 institutes and centers, and key officials in the Office of the NIH Director were interviewed. Each was asked about the direction of research within their respective organization, and for NIH Bethesda as a whole.

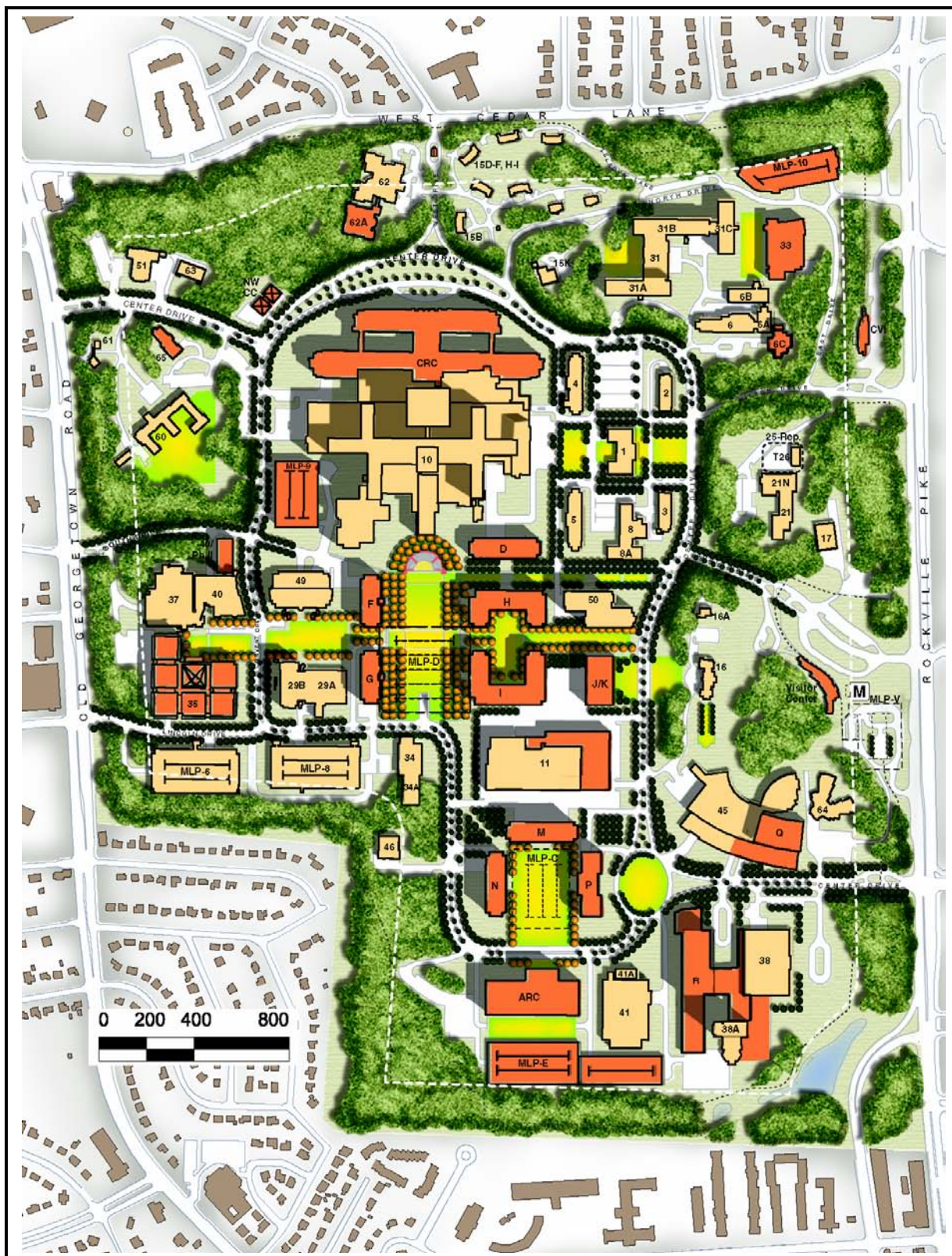


FIGURE 4-2 THE MASTER PLAN 2003 UPDATE ILLUSTRATIVE PLAN.

The interviews were supplemented by questionnaires that asked for more detail. Those interviewed emphasized the importance of the campus intramural research program, and increasing collaboration among the Institutes, Centers, and clinical research facilities, confirming the findings done for the 1995 Master Plan. The results of the interviews and the questionnaires were analyzed in to derive a cumulative potential Bethesda campus population.

Most of the potential growth in campus population was attributable to the desire on the part of the Institutes and Centers for increases in or consolidation of intramural research facilities on the campus. Although personnel projections, based on the interviews, exceed 22,000 in the aggregate, the Master Plan 2003 Update is based on a campus population ceiling of 22,000 for several reasons revealed in the planning process. While NIH can still maintain its peak hour trip generation at or below 1992 levels at higher campus population levels, and subsequently meet the conditions of the Memorandum of Understanding with planning agencies, the traffic volumes generated by a campus population greater than 22,000 may produce unacceptable levels of congestion at the intersections around the campus periphery.

The ICs indicated in the interview process that concentration of intramural research at the Bethesda campus, was preferable to administrative functions. Research requires more space per employee, and generates more utility demand per unit of building space than most other occupancies. If research facilities are maximized on the campus, there is insufficient room for expanding the central heating and cooling plants in Building 11 beyond a level of 22,000 employees when research functions are emphasized. While individual research buildings with independent heating and cooling systems could be built, such systems would not have the same operating reliability and efficiency, nor cost effectiveness.

As development density increases, construction of new facilities, and maintenance of existing infrastructure becomes more intricate and complex with associated added costs. This situation begins to occur when the population is greater than 22,000.

NIH has therefore, determined that the practicable capacity of the Bethesda is 22,000. The balance of any growth beyond this level will have to occur elsewhere in locally leased or other types of facilities. While a 22,000 population is below that ideally desired by IC leadership, it allows for a balanced response between future NIH programmatic biomedical research needs, and the tenets, goals, and constraints on which the Master Plan itself is based. Analysis of the IC projections was revised to reflect this premise. For planning purposes, the resultant potential campus growth in personnel is projected to be as follows:

<u>Master Plan</u>	<u>Campus Population</u>
2003	17,511
End of First Phase	18,510
End of Second Phase	19,951
End of Third Phase	20,409
End of Final Phase	21,878 (22,000)

4.7.1.2 Building Space

The Bethesda campus had approximately 7.0 million gsf of floor space in 2000. In 2001, three buildings (Laboratory Buildings 40, 50, and the East Child Care Center) were partially or completely occupied during the year, while Building 35, which housed a dining center and child care center, was vacated and demolished. The North electric power substation was built in 2002, and equipment installed in 2003.

The campus building status in 2003 has been used as the baseline condition in the Master Plan Update. Year 2003 campus buildings are listed in Table 4-1 by building use. The campus has over 7.4 million

Building	Clinical	Research & Research Support	Office/ Admin.	Animal	General Support	Utility	Residence	Other
1			95948					
2		46860						
3		48860						
4		91292						
5		91292						
6, 6A, 6B		145043						
7		48860						
8, 8A		99296						
9		32500						
10 hospital	1246837							
10 clinical	1025843							
11						150000		
11 phase II						82400		
12, 12A, 12B					156236			
13					212690			
14 all				245252				
15B			8065					
15C-15I							52345	
15K		11670						
16, 16A			20360					
17						7651		
18, 18T				6550				
21, 21N		36216						
22, 22A					15810			
25					4445			
28 all				26501				
29		89949						
29A		106694						
29B		102700						
30		93940						
31A-C			582037					
32				9768				
34						72547		
36		236285						
37		248469						
38, 38A					452467			
40		84600						
41, 41A		141,794						
45			372535					
46						11526		
49		270311						
50		290000						
51					22000			
53						3968		
60			67500					
61, 61A					3296			
62							37565	
63						10030		
64								21000
T2					495			
T14					4000			
T23					5376			
T26					2900			
T39					5160			
T46								3000
SUBTOTAL	2272680	2316631	1146445	288071	884875	338122	89910	24000
TOTAL								7360734

TABLE 4-1 EXISTING (YEAR 2003) OCCUPIABLE BUILDING SPACE BY TYPE (in gross sf).

occupiable gross square feet (gsf) of floor space, excluding parking structures. Buildings have been assigned to a space type category based on the dominant or chief use within the building, although other types of space are generally present. Many research facilities, for example, have laboratories, offices for management and researchers, animal spaces, and general support such as material supply and waste handling, but are considered to be laboratories for impact purposes. Each type of space use generates different impacts, particularly in terms of utility usage, and the breakout by use differs from that given in the Master Plan, which uses different classifications for some individual buildings for planning purposes.

Master Plan building space projections are shown in Table 4-2. Proposed projects are listed on the left side of the table with cumulative totals for each Master Plan phase. The end of the Third Phase corresponds to the 2020 Master Plan planning horizon. Development of sites with Buildings D, H, and Q would occur beyond that year in a Final Phase to campus buildout. While individual buildings or sites are listed in the general order of potential development, actual implementation at any site can shift between phases depending on circumstances. Three columns on the right side track buildings by proposed disposition: new construction, renovation or reuse, or demolition. Most of the projects identified by an alphabet letter have been designated as laboratory or research facility sites, but they could be used for other suitable purposes.

Programming for future new space needs is based on a space criteria of 540 gsf per researcher for laboratory space and 273 gsf per employee for office space. It was assumed that existing buildings to remain would not be decompressed, i.e. the gsf per worker would not increase, but remain unchanged. The square foot areas of short term projects renovations are based on current project planning. Space other than that noted above is projected using standard architectural or planning factors.

Total campus building space would increase to about 10.7 million gsf, if all the prospective building projects were built. This would represent an overall increase of about 46 percent over the 7.4 million gsf existing in 2003. Proposed new parking structures, either in new MLPs or under proposed campus malls, would add another 1,542,000 gsf that is not included in the table.

If the Master Plan is fully implemented about 4.6 million gsf of new occupiable space would be added to the campus through 26 new construction projects exclusive of parking. Proximity to the Clinical Research Center, a major investment, is a vital element in much of the campus research. Maximizing future laboratory and research space is the best development option for the campus. Under full implementation of the Master Plan, research space would double from about 2.3 million to nearly 4.5 million gsf at full buildout. The proportion of campus space devoted to laboratories and direct research would increase from 31 percent of total space to 42 percent. The average space per worker would increase from 420 gsf in 2003 to 487 gsf under full implementation conditions.

The Master Plan retains over 80 percent of the existing space. A total of 5.55 million gsf, or 75 percent of existing space, would be retained without renovation. About 567,000 gsf would be renovated or adapted for new use. Most of this renovated space is associated with Building 10, where existing hospital and clinical research areas would be converted to more general research uses. Virtually all of the proposed demolition is needed to make room for new construction, and more efficient use of ground space within the developable portion of the campus.

4.7.1.3 Major Features

The major features of the Master Plan 2003 Update are:

- The Neuroscience Research Center

Building	Clinical	Research & Support	Office/ Admin.	Animal	General Support	Utility	Residence	Other	Total Active Space	New	Renovation	Demolition
EXISTING TOTAL 2003	2272680	2316631	1146445	288071	884875	338122	89910	24000	7360734			
65 (Family Lodge)							26500			26500		
62 (Children Inn add)							34000			34000		
NR PH I		265000								265000		
Clinical Research Cen	1050000									1050000		
Commercial Veh. Inspection					6719					6719		
10 stabilize/upgrade	-297756										See 10 reoccupy	-236285
36		-236285								20528		
Gateway Visitor Center		150000			20528					150000		
33		16500								16500		
6C addition										335000		
NR PH II		335000								49227		
10 Central Core		49227								49227		
3 research to office		-48860	48860								48860	
10 E & F wings	-147000										See 10 reoccupy	
NW Child Care								21000		21000		
T23					-495							-495
T39					-5160							-5160
25 Replacement					12000					12000		
22,22A					-15810							-15810
25					-4445							-4445
T23					-5376							-5376
CUM TOTAL 1st PHASE	2877924	2847213	1195305	288071	892836	338122	150410	45000	8634881	1986474	48860	-267571
Animal Research Center				335000						335000		-245252
14				-245252								-26501
28				-26501								-6550
18				-6550								-9768
32				-9768								
M		178500								178500		
11 Phase III						35000				35000		
40 Phase II		50000								50000		
N		137700								137700		
10 Reoccupy		444756									444756	
10A	-56000											-56000
R					389370					389370		
12, 12A, 12B					-156236							-156236
P												
34/Campus Center		183600						72547		183600	72457	
CUM TOTAL 2nd PHASE	2821924	3841769	1195305	335000	1125970	300575	150410	117547	9888500	1309170	517213	-500307
continued next page												

TABLE 4-2 PROJECTED MASTER PLAN ALTERNATIVE OCCUPIABLE BUILDING SPACE (in gsft).

Building	Clinical	Research & Support	Office/ Admin.	Animal	General Support	Utility	Residence	Other	Total Active Space	New	Renovation	Demolition
29		-89949										-89949
7		-48860										-48860
9		-32500										-32500
J/K			212175							212175		
13					-212690							-212690
T-14								-4000				-4000
T-46								-3000				-3000
30		-93940										-93940
I		249900								249900		
G		112200								112200		
F		149600								149600		
CUM TOTAL 3rd PHASE	2821924	4088220	1407480	335000	913280	300575	150410	110547	10127436	723875	0	-480939
D		168700								168700		
Q			190000							190000		
H		229500								229500		
CUM TOTAL FINAL PHASE	2821924	4486420	1597480	335000	913280	300575	150410	110547	10715636	588200	0	0
MASTER PLAN TOTAL										4607719	566073	-1248817

TABLE 4-2 (con't) PROJECTED MASTER PLAN ALTERNATIVE OCCUPIABLE BUILDING SPACE (in gsf).

The Neuroscience Research Center (NRC) will be a 600,000 gsf laboratory where research on the brain, head, and neurological systems conducted by ten individual NIH Institutes will be merged into one consolidated facility. It will be built in the West Quadrangle replacing Buildings 35 and 36. Building 35 housed a dining center and the West Child Care Center; Building 36 contained research laboratories.

To maintain ongoing research, the NRC will be built in two phases. The first phase started in September 2001 with the demolition of Building 35. Phase I of the NRC, built in its place, is scheduled for occupancy in 2004. Laboratory Building 36 will then be demolished to make room for NRC Phase II construction after transfer of Building 36 researchers to the Phase I facility. Phase II would be occupied by researchers transferred from other laboratories on the campus. Phase II is scheduled for completion in 2008.

- Clinical Research Center/Building 10 Renovations

The Master Plan 2003 Update accounts for progress and developments in the Clinical Research Center (CRC) and Building 10 stabilization and core renovation program. The new Mark Hatfield Clinical Research Center is under construction and scheduled for occupancy in 2004. It will replace the existing Warren Magnuson Clinical Research Center. It will include a 240-bed inpatient hospital occupying about 600,000 gsf of floor area, and 450,000 gsf of associated clinical research laboratories as proposed in the 1995 Master Plan. Employees would be transferred from the old clinical center to the new Hatfield CRC.

Completion of the Hatfield CRC will then permit initiation of the next program step, stabilization of Building 10 and electrical and mechanical renovation of central wings E and F within Building 10. The stabilization program would be a precursor to a second step, a more complete program that would convert the Magnuson hospital and clinical research to more general biomedical research facilities. About 445,000 gsf of space would be stabilized and renovated. Separately, 49,227 gsf of space will be added to the central core of Building 10 by filling in or adding floors to an existing interior atrium. Since this space is interior to the building, it does not appear in Figure 4-2. Building 10A would be demolished.

- Northwest Sector Amendment Area

The Master Plan 2003 Update acknowledges and incorporates the changes in the 1995 Master Plan Northwest Sector Amendment. Projects proposed in the amendment are in various stages of implementation. Center Drive has been realigned to its ultimate Master Plan location and configuration. The Family Lodge and an addition to the Children's Inn are in the construction phase of development. The North electric power substation and the fire station were built in 2003.

- Central Heating and Refrigeration Plant (Building 11) Expansion

Planning for utility and support infrastructure improvements has been updated to account for Master Plan revisions and the changing status of projects proposed in the 1992 Master Utility Plan (Master Utility Plan: 2000 Update, Mueller Associates II, Inc./TA Engineering, 2000). Many of the projects proposed in 1995 have been completed, or are in the process of being implemented. In the latter case, they are either under construction or in the design phase.

Work completed at Building 11 includes the installation of Boiler 5, overhaul of and retrofit of low nitrogen oxides emitting burners on Boilers 1 through 4, combining individual boiler stacks into a single stack, and dismantling and removal of the medical/pathological waste incinerators.

A 23 megawatt (MW) electric power cogeneration facility to be built and operated by PEPCO is currently in the performance testing phase. Once operations start, PEPCO will be responsible for unit operations

for the first ten years, and NIH will then take over ownership and operation. Exhaust heat from the power generating turbine will be used to generate steam in Boiler 6 for NIH use once operation starts. The facility is currently in the systems testing phase, and is scheduled to begin operation in 2004. It will increase plant firm steam generation capacity from 600,000 to 780,000 lb/hr.

The program to expand the chilled water plant is underway. It includes consolidation of chilled water production facilities in Building 11 and the eventual closure of facilities in Building 34. Installation of Chillers 22 through 25, each with a 5,000 ton capacity, and their associated cooling towers was completed in 2003. Chillers 26 through 27 are scheduled to follow in 2004.

The Master Plan 2003 Update would increase the amount of campus space at ultimate buildout to about 10.76 million gsf. Much of the increase would be laboratory/research space, which has a much greater utility demand per unit square foot than other types of building space. Projected utility demands therefore will increase at a greater proportionate rate than building space.

New projects proposed in the Master Utility Plan 2000 Update and Master Plan 2003 Update accommodate the projected increases in steam and chilled water demands. One additional boiler, Boiler 7, would increase the projected firm capacity of the steam generation plant to an ultimate 980,000 pounds per hour.

On the chilled water side, four additional chillers, 28 through 31, would be installed in Building 11, while the facilities in Building 34 would be retired. The net result would increase plant total capacity to 80,000 tons.

- Waste Handling and Treatment

The 1995 Master Plan proposed demolition of Building 21 and its replacement with Building E, a research facility. Building 21 functions would have been moved to Building M on the south side of Building 11. Under the Master Plan 2003 Update, Building E has been eliminated. Building 21 and its waste marshalling, treatment, storage, and shipping facilities will be retained at the existing site. Medical/pathological waste marshalling functions now conducted in Building 25 would be moved to a replacement facility built in the vicinity of Building 21. Although not listed in Table 4-2, the Master Plan proposes upgrading Building 21 during the planning period.

- East Quadrangle

Only four buildings will be located in the East Quadrangle on the north side of Building 11 under the Master Plan 2003 Update instead of five proposed in the 1995 Master Plan. Building sites H and I are proposed as potential laboratory sites. Site J/K would house general support services in a new Research Services Building.

- South Quadrangle Revisions

Planning for the South Quadrangle on the south side of Building 11 has undergone minor revisions in configuration and proposed building function from the 1995 Master Plan. The Loop Road has been shifted northward along the southern section of the quad. The Animal Research Center (ARC) has also been shifted northward to 1995 Master Plan Site O, so that it becomes the building defining the southern edge of the Quad. Building O has been eliminated. Building M, which was previously designated as a general support services building in the 1995 Master Plan, would now be used as a research building.

- Parking

The updated Master Plan continues to emphasize relocation of surface parking to multiple level parking structures (MLPs), particularly those spaces in the buffer zone along the campus periphery. The Master Plan 2003 Update provides for additional needed parking consistent with the potential increase in campus population. This is accomplished by increasing the number of spaces in MLP-9 at the site proposed in the Northwest Sector Amendment, and at MLP-10, MLP-C, and MLP-D at their 1995 Master Plan locations, to accommodate the potential increase in buildout campus population (18,000 in the 1995 master Plan, 22,000 in the 2003 update.).

One new MLP is proposed to handle further increases and relocation requirements. MLP-E would be located on the south side of the Building 41 and the new Animal Research Center. It would be built into the hillside so that several decks would be below ground level on the south side. It would replace surface parking proposed for this area in the 1995 Master Plan.

- Building Site R

The National Library of Medicine (NLM) is located in Building 38 and 38A in the southeast sector of the campus. Its statutory mandate is to apply its resources broadly for the advancement of medical and health related sciences. Open to the general public, the library has the largest collection devoted to a single scientific discipline, i.e. medicine, in the world. It also maintains over 40 information or data bases accessible by computers around the world as well as conventional material resources. The Master Plan Update provides space for a potential addition to the NLM on Building Site R.

4.7.2 No Action Alternative

Normally, the No Action Alternative is defined as no net growth in employees and facilities from baseline conditions. However, it would be unrealistic to expect no action whatever over the two decade planning horizon. Changes can occur in response to Congressional actions, or revisions to building and safety codes. It is assumed under the No Action Alternative that NIH would maintain and repair facilities in response to these requirements.

The No Action Alternative also includes those projects to which NIH is committed by past actions by NIH or others. The status of these “committed” projects range from allocated Congressional budget funding, through design and construction, to near readiness for occupancy. The No Action Alternative assumes that all the projects listed in Table 4-3 are committed to the point that they will be built and occupied or go into service.

Future conditions for the Magnuson Clinical Research hospital and Building 10 are ambiguous in the No Action case. The existing facilities are inadequate in terms of modern laboratory space and internal utility services although improvements have been made under the Essential Maintenance and Safety Program to maintain reasonable operational levels.

Construction of the new Clinical Research Center implies a commitment to renovation of the old clinical center in Building 10. Stabilization and renovation does not necessarily add personnel, but is essential to resolving operational problems. For the No Action case, it has been assumed this will occur.

<u>Building No.</u>	<u>Building</u>	<u>Change in gsf</u>	<u>Total gsf</u>
	Existing		7,360,734
65	Family Lodge	26,500	7,387,234
62A	Children's Inn Expansion	34,000	7,421,234
35	Neuroscience Research Center, Phase I	265,000	7,686,234
3	Convert Lab to Office	0	7,686,234
--	Hatfield Clinical Research Center	1,050,000	8,736,234
6C	Lab Addition	16,500	8,752,734
--	Commercial Vehicle Inspection Facility	6,719	8,759,453
—	Gateway	20,528	8,779,981
--	Gateway Garage	0	8,779,981
33	Research Facility	150,000	8,929,981
--	MLP-9	0	8,929,981
--	MLP-10	0	8,929,981
10	Stabilization and Renovation	0	8,929,981

TABLE 4-3 NO ACTION ALTERNATIVE PROJECTS.

Additional conditions and assumptions made to define the No Action Alternative are given below.

- Personnel

The 2003 campus population is 17,511. Under the No Action Alternative, the employee population would increase to an estimated 17,900, or by about 400. Most of this increase would be attributed to Research Building 33, which is projected to house about 290 new personnel. Researchers who would occupy the Neuroscience Research Center, Phase I, would transfer from other NIH facilities on campus. However, an estimated 50 new workers would be employed in the new dining center, which is included in Phase I. There would be no net change in personnel involved with the Building 10 renovation. The remaining 60 personnel would be divided among No Action Alternative projects individually make small or no contributions to employee growth.

- Space

The No Action Alternative projects would increase the occupiable space on campus by an estimated net 1,569,000 gsf. About two-thirds of this growth, 1,050,000 gsf, would be attributable to the new Mark Hatfield Clinical Research Center hospital and associated clinical research facilities.

- Utilities

Committed and necessary projects would be implemented. The chilled water plant would continue through the Phase II expansion. Installation of Chillers 26 and 27 is now underway. Building 34, the auxiliary chilled water plant, would remain in service. On the boiler side, the COGEN/Boiler 6 would go into service, as in the Master Plan Alternative, and be sufficient to meet No Action building growth. The No Action Alternative would also include construction of the South Pond. Other utilities would be maintained as necessary.

- Parking

In general, parking under the No Action Alternative would continue in the current configuration of surface lots and Multiple Level Parking (MLP) structures. However, changes would occur. MLP-9 would be built, and MLP-10 would be built to replace surface lot parking that would be lost through construction of Building 33 and the Commercial Vehicle Inspection Facility. It is assumed that spaces would be adjusted at undesignated locations around the campus to maintain a 0.50 parking space per employee ratio. The 350 space parking garage at the Gateway Center for campus visitors would also be built. Internal campus visitor spaces would be reduced.

- Access and Security

It is also assumed that the security perimeter projects would be implemented.

4.8 Off Campus Development

The leadership of the Institutes and Centers, were interviewed separately as part of 1995 Master Plan development. Nearly all ICs stated that their programs should be kept or brought together at one place, preferably on the central campus in Bethesda. The ICs cited examples of the research and grant personnel, then in locally leased space, who were out of daily contact with their intramural and other colleagues, and research in fields other than their own. Off-campus NIH researchers lamented the lack of opportunities that foster innovative scientific inter-relationships and collaboration, and of the frustrations of going to the main campus for meetings, seminars or other business because of the productive time lost to travel between NIH facilities.

Of utmost importance to nearly all ICs, however, is the perpetuation of the heart of intramural research at NIH Bethesda with its Clinical Research Center. Nearly all Institutes have research programs in Building 10. The intramural research scientists consider the proximity of their laboratories to patients to be at the core of their success in rapidly converting research findings into actual recommended medical care practices, and they anticipate continued or increased presence in the Clinical Center and the research laboratories associated with it. The critical mass of personnel and facilities in intramural clinical research at NIH Bethesda, which revolves around the Clinical Center, must be preserved either at the main campus, or by a clinical research capability with associated adjacent laboratories at a new location.

For the Master Plan 2003 Update, the IC leadership was reinterviewed in the programming process to obtain information for space and personnel projections. They reaffirmed the importance of relationships between the ICs on campus and the proximity of laboratories, clinical research center, and support facilities to one another in conducting efficient and effective research. They noted the current trend for ever increasing collaboration among the Institutes and Centers on research programs, as exemplified by the Neuroscience Research Center which will house researchers from ten Institutes, and where support facilities will be shared in common. Similarly, the concept behind the recently built Vaccine Research Center cuts across old organizational boundaries with representatives from different Institutes working together.

Each IC was asked independently about the direction and potential growth in research within their IC. Projections for the next five years can be made with some assurance; long term projections over the 20-year planning horizon are less certain. When the range in values given by the ICs are combined and analyzed, the projections exceed what can be accommodated on the Bethesda campus within current constraints. Given the facility advantages present at NIH Bethesda and identified by the ICs, the Master Plan update recognizes that the best use of the campus is maximization of intramural research functions. Laboratories will comprise most of the future growth in space. Only essential support that must be

located on the campus for its proper function is proposed. When site and transportation constraints are considered, a campus population ceiling of about 22,000 is established.

Future NIH off campus facilities in the region could be located in scattered or consolidated leased spaces, on a new campus, or in some combination of these options. The issue involved in off campus facilities are complex. They are dependent on the location, size, nature, of each facilities as well as the surrounding environment in the vicinity. The Bethesda campus is the focus of the Master Plan and this Environmental Impact Statement. Issues involving off campus facilities are beyond the scope of these documents. Changes in off campus facilities would be covered by associated planning and environmental studies and documentation prepared at the appropriate time during the decision making processes for these changes.

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Section Five

Affected Environment / Environmental Consequences

The existing environment and potential impacts of the Master Plan are complex. For each environmental topic, information on existing conditions and potential environmental consequences have been merged into one subsection to eliminate repetition of material, and for the convenience of the reader.

The proposed action is a Master Plan or long range guidance document, and no physical development will actually occur under the proposed action. No direct impacts or consequences will occur as a result of the proposed action. Environmental consequences are conditional, and dependent on the extent to which proposed projects are actually implemented or built. This EIS presents an overview of the cumulative environmental consequences that would occur if all the proposed facilities were to be built. Actual cumulative impacts may range anywhere between those for the No Action Alternative and the Master Plan Alternative.

5.1 SOCIOECONOMIC/LAND USE

5.1.1 Overview

The National Institutes of Health main campus is located in Montgomery County, Maryland, one of the largest jurisdictions in the Washington, D.C. region. As a result of expansion of the urbanized area, cross-commuting patterns, and other economic interrelationships, the federal Government recently designated a broader Consolidated Metropolitan Statistical Area for this region. This new CMSA encompasses both the Baltimore and Washington metropolitan areas, incorporating an area of nearly 9,600 square miles circumscribed by a 75 mile radius around downtown Washington, D.C. The limits of the CMSA extend from the Pennsylvania border to the edge of metropolitan Richmond, Virginia. On an east-west axis, the CMSA stretches from Queen Anne's County, Maryland, on the eastern shore of the Chesapeake Bay to Berkeley and Jefferson Counties, in the West Virginia panhandle (Population of Metropolitan Areas and Component Geography: 1980 and 1990 (6/30/93 definition), 1990 CPH-L-145, U.S. Bureau of the Census, 1993).

The region is growing at a very rapid rate, with communities and employment spreading over an ever-widening geographic area. This spread is reflected in the residential location patterns of NIH employees and the broad area affected by NIH's "local" procurement.

The population of the Washington-Baltimore CMSA in 2000 was 7.6 million, making it the fourth largest in the nation out of 280 designated CMSAs. It is also one of the most rapidly growing of the larger urbanized areas, with a population increase of 13 percent between 1990 and 2000. The MD-VA-DC Metropolitan Washington Area portion had 5.3 million people in 2000, an increase of 26 percent over 1990.

Montgomery County is the second largest jurisdiction within the Washington-Baltimore region. With 873,000 people in 2000, it is second only to Fairfax County, Virginia, which has a population of 970,000. Baltimore County ranked third, with 754,000. Montgomery County's population represents about 16 percent of the total MD-DC-VA Metropolitan Area population, and about 11 percent of total CMSA population.

Montgomery County has been one of the most rapidly growing of the larger jurisdictions in the region over the past decade. Population increased by nearly 116,000 between 1990 and 2000, or 15 percent. Only Fairfax County experienced a larger absolute growth with a 152,000 population increase during the same period.

Projections call for Montgomery County to continue to grow, albeit at a somewhat slower rate than over the past decade. Between 2000 and 2020, Montgomery County is expected to increase by about 145,000 people, bringing its total population to 1,018,000 (Preliminary Population Projections for Maryland's Jurisdictions, Maryland Department of Planning, 2001).

The County's land area is approximately 495 square miles, or about 320,000 acres. Between 1960 and 1991, the amount of developed land in the County more than tripled. As of 1960, about 49,000 acres, or 15 percent, of the County's land area had been developed; by 1991 a total of about 155,000 acres, or 48 percent, was urbanized. Residential land uses have grown most rapidly, with single family dwellings occupying the largest portion of the expanded urbanized area. In 1960, 23,000 acres, or 7.2 percent of the land area, was in single-family use, and by 1991, single family residential areas had increased to 86,800 acres, or about 27 percent of the County's land area. Multi-family residential land use has been clustered in a relatively few locations, utilizing far less land - 700 acres in 1960 and 6,700 acres in 1991, the latter scarcely over 2 percent of the County's land (General Plan Refinement Goals & Objectives: Then & Now, Supplemental Fact Sheets, Montgomery County Planning Department, January 1993). One of the largest concentrations of multi-family housing in the County is in Bethesda.

Including local and federal government, land use devoted to institutional uses also increased, from 10,600 acres in 1960, to 22,800 acres in 1991. The National Institutes of Health main campus with its 310 acres is counted in this institutional category of land uses.

Montgomery County had a total of nearly 296,000 housing units in 1990, having added over 8,000 dwellings a year in the two decades since 1970. The number of housing units nearly doubled during this period, exceeding the 56 percent growth rate experienced in the metropolitan region as a whole. During this period of rapid growth, the County's housing stock also changed significantly. Single family detached housing declined in share of the market from 68 percent to 52 percent, while townhouses increased from just 1 percent in 1970 to 17 percent (50,000 units) in 1990 (ibid). Multi-family units remained relatively constant with a 30 percent share of the mix. Montgomery County housing units increased to 334,000 in 2000.

Growth in housing supply has basically followed the patterns established in the County's General Plan, known as Wedges and Corridors. That plan sought to avoid suburban "sprawl" by channeling growth into the County's radial transportation corridors - particularly I-270 and U.S. 29 - and into the more densely developed down-County area nearest the District of Columbia, known as the urban ring, while preserving the wedges in between the corridors for rural land use and open space. Bethesda and NIH are in the urban ring. Residential zoning under the General Plan has been "pegged" to growth projections for the year 2000. Undeveloped residential land under densities projected in the Plan could accommodate 144,300 new dwellings. At County absorption rates of the past 20 years, this would be an 18-year supply. Less than 10 percent of the total future residential development areas are within walking distance of Metrorail stations in the County.

5.1.2 Land Use and Regional Planning

Montgomery County is divided into 37 planning areas. Master plans for each planning area provide a comprehensive set of recommendations and guidelines for growth and development while protecting existing land uses, community facilities and needs, and environmental and historic resources, and maintaining the transportation network. The area master plans are combined to form a general plan for the County, which in turn, is an element in regional planning for the Washington metropolitan area.

Sector plans are prepared for local communities and heavily developed areas within the planning areas.

Master area and sector plans are prepared by the Maryland-National Capital Park and Planning Commission (M-NCPPC) and pass through several stages of development before adoption: preliminary draft, final draft, and adopted plan.

The NIH Bethesda campus is located in the Mid-Bethesda sector of Bethesda-Chevy Chase, Montgomery County Planning Area 35, the southernmost in the County (Figure 5-1). The applicable planning document for the area is the Bethesda-Chevy Chase Master Plan, M-NCPPC, 1990, which was approved and adopted by M-NCPPC in April, 1990. The purpose of the plan is to establish a policy framework that will guide the direction of Bethesda-Chevy Chase for the next 20 years.

Bethesda was a suburban village until the 1950s, a focal point for shopping and community services on a limited scale. Now, it is the "downtown" or Central Business District (CBD) of the planning area with the greatest concentration of commercial and office development within the Bethesda Chevy Chase planning area. Planning for the Bethesda CBD is conducted in much greater detail, nearly on a parcel by parcel basis, in the Bethesda CBD Sector Plan. Planning for the two areas is coordinated and complementary. From 1990 to 1992, M-NCPPC undertook research and elaboration of preliminary proposals that were presented to the Montgomery County Planning Board in July 1993. A Citizen Advisory Committee, including representation from senior NIH staff, participated in formulating the Draft. After public review in hearings and work sessions, the Comprehensive Amendment to the Bethesda CBD Sector Plan was adopted by the County Council in 1994.

The area master and sector plans are tied to County planning through the Annual Growth Policy (AGP) for Montgomery County (FY 00 Annual Growth Policy, Montgomery County Planning Board, 1999), which is updated each year. This document provides guidelines that translate needs indicated in local plans into capital improvements, not only for a specific area, but also County-wide.

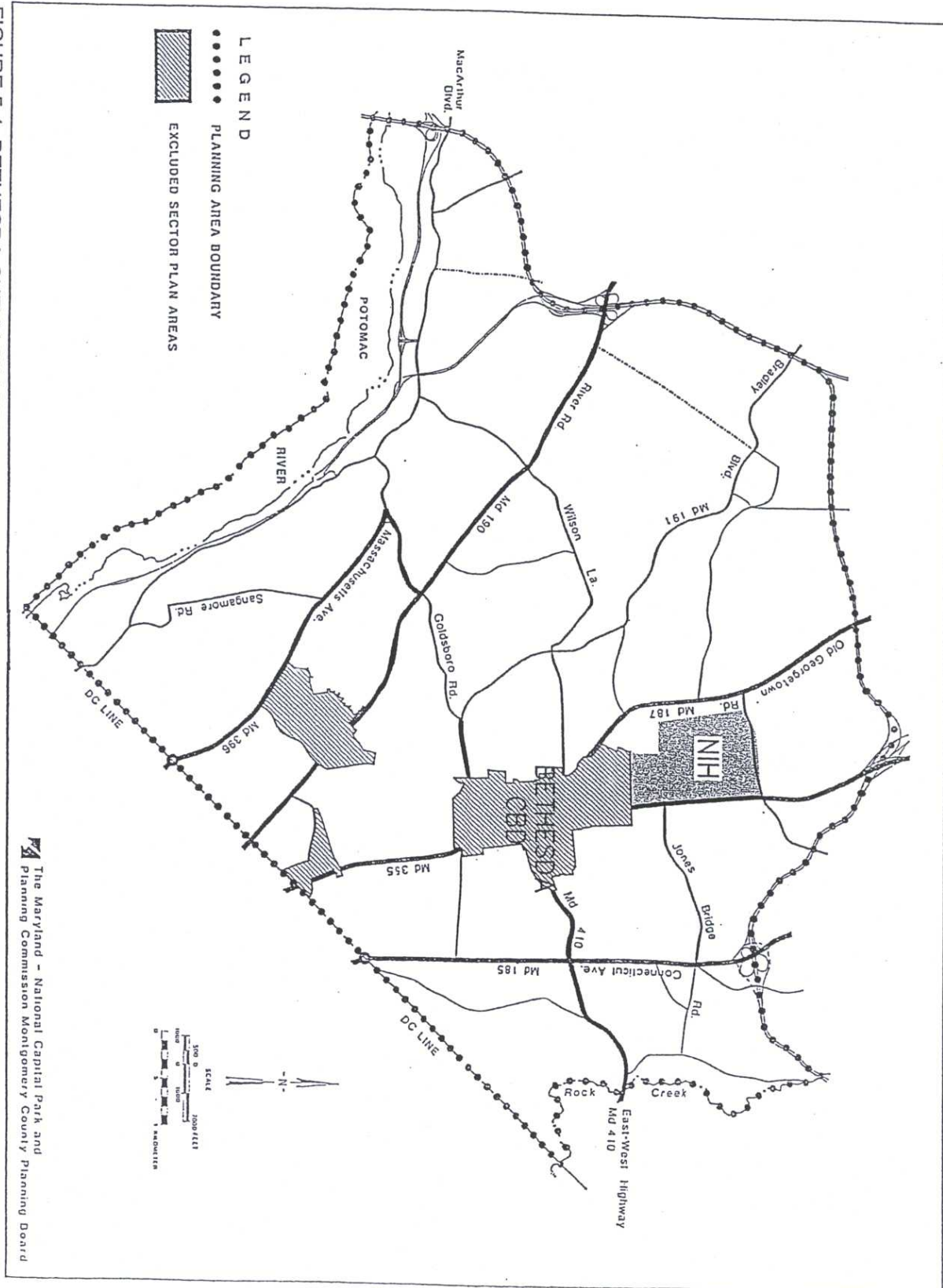
5.1.2.1 Bethesda-Chevy Chase Master Plan

The Bethesda-Chevy Chase (BCC) Master Plan establishes seven goals and objectives for the planning area:

- Perpetuate and enhance the high quality of life which exists in the BCC Planning Area.
- Achieve a level of future employment development that is in balance with a high quality of life and the transportation capacity of the Planning Area.
- Provide for a balanced housing supply so that persons of varying income levels, ages, backgrounds, and household characteristics may find suitable housing appropriate to their needs.
- Protect the high quality residential communities throughout the Planning Area as well as the services and environmental qualities that enhance the area.
- Achieve a significant shift of new travel from auto to transit and other mobility alternatives.
- Protect the natural resources and environmental qualities of the Planning Area.
- Contribute to a strong sense of community and help reinforce community cohesion.

The plan recommends reconfirmation of the existing residential character and zoning of the planning area. Three levels of future development were assessed assuming a set of moderate improvements to the road system. The plan endorses a moderate level of development in terms of employment and housing,

FIGURE 5-1 BETHESDA CHEVY CHASE PLANNING AREA.



provided that a balance is maintained with the overall transportation capacity of the area. This proposed level of development can be implemented through the following recommendations:

1. Maintain the relative level of households compared to jobs to reduce the pressures on commuting into the area.
2. Share new employment development between the Sector Plans and the federal employment centers.
3. Locate new employment and residential development in existing centers near Metro stations.
4. Continue to recognize the importance of biomedical and medically-oriented development in the area, but place less emphasis on large-scale office projects.
5. Support existing businesses, including those that meet community retail and service needs.
6. Support increased housing density and types in Sector Plan areas and where compatible with nearby properties.

Transportation improvements are assumed to be limited to moderate ones applied to the existing highway system, coupled with a strong effort to increase use of public transit and other alternatives.

5.1.2.2 The Bethesda CBD Sector Plan

The Bethesda Central Business District (CBD) adjoins the southern boundary of the NIH campus. It covers 405 acres, an area about one-third larger than the NIH campus. In 1990, the CBD contributed 5% of Montgomery County property tax revenues and 15% of the yield for commercial properties (BCC Chamber of Commerce, Statement Regarding Bethesda Central Business District Plan, Nov. 1991).

Unlike most suburban commercial core areas that are predominantly office complexes, the CBD contains a wide variety of retail space, restaurants, and many apartments and hotels (Figures 5-2 and 5-3). The core of development is concentrated around the Bethesda Metro subway station at Wisconsin Avenue and East-West Highway. This is surrounded by lower density commercial development that transitions gradually to surrounding residential areas. A feature of Bethesda is the presence of more than 170 restaurants. Many of these are located in the Woodmont Triangle, the area in the northern part of the Bethesda Central Business District CBD between Old Georgetown Road and Wisconsin Avenue. The area immediately to the south of NIH is occupied by mid and high rise apartment complexes that front on Battery Lane.

While the Sector Plan recommends a wide range of densities for the various components of the business district, it concentrates the highest densities in the Metro Core centered on the Metrorail Station and the intersection of Wisconsin Avenue with Old Georgetown Road and East-West Highway. It calls for gradually decreasing densities between the core and the CBD fringe and both establishment and maintenance of buffers between the CBD and residential and institutional uses abutting the CBD fringe.

In the immediate vicinity of the NIH campus, land use to the east of NIH and north of Jones Bridge Road is institutional with the National Naval Medical Command and the Uniformed Services University of the Health Sciences occupying a large block of land extending to Rock Creek. The Stone Ridge School of the Sacred Heart lies between the Naval Medical Center and Cedar Lane, although this property is zoned for single family residential. All remaining frontage surrounding NIH is zoned residential except for a commercial area between Woodmont Avenue and Wisconsin Avenue to the southeast of the campus.

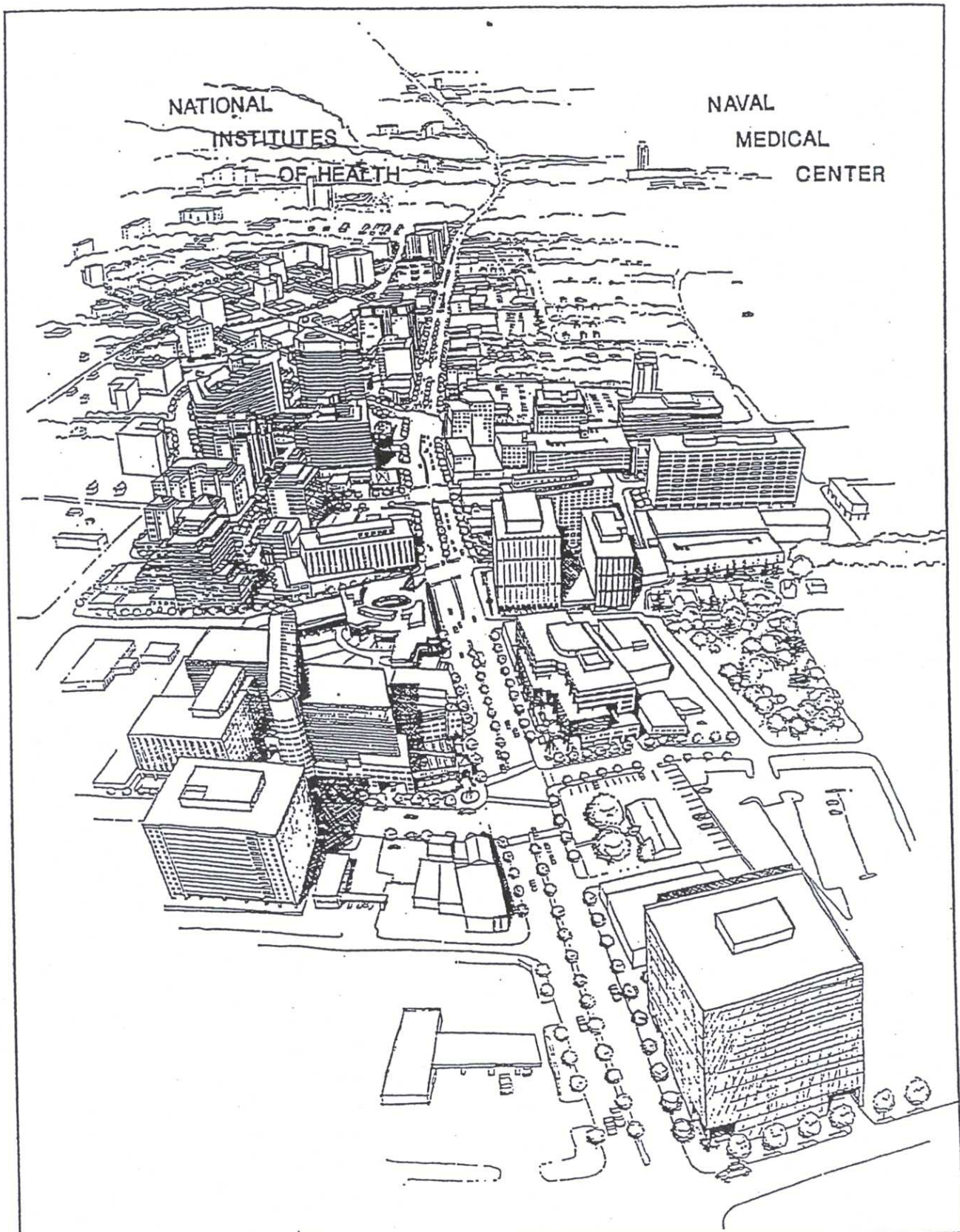


FIGURE 5-2 THE BETHESDA CENTRAL BUSINESS DISTRICT (CBD).

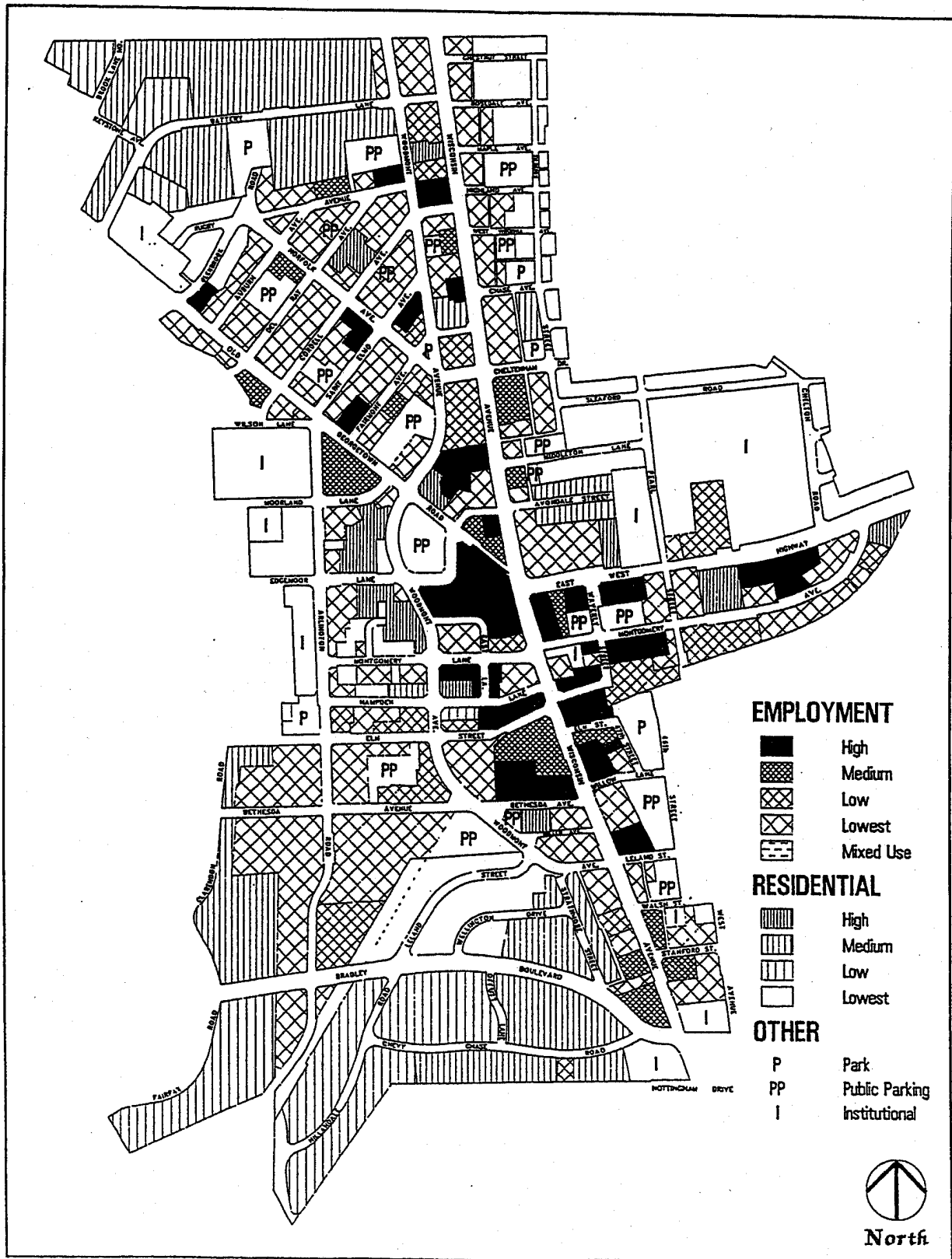


FIGURE 5-3 GENERAL LAND USE IN BETHESDA CBD.

All residential areas are zoned R-60, single family residential, except for the area in the Bethesda CBD where the zoning is R-10 or RT-12.5 for multifamily high density residential use. Land use generally conforms to zoning. Special zoning exceptions have been granted to schools, churches, Suburban Hospital, professional offices, and community oriented associations along Rockville Pike, West Cedar Lane, and Old Georgetown Road.

In the future, the Bethesda-Chevy Chase Master Plan recommends that the existing zoning surrounding the NIH campus remain unchanged. It does not recommend redevelopment, but does recognize that large lots and special exception sites may be developed in the next 20 years. For Old Georgetown Road and adjacent communities, the objective is to maintain the residential character, preserve neighborhood stability, and discourage further special zoning or land use exceptions, except for those that serve the community (Figure 5-4). If development of large lots and special exception sites should occur in the future, the plan recommends that the new land use be residential. If this residential development should occur, then there is the potential for construction of 193 dwelling units around the periphery of the NIH campus (Table 5-1). Development of the Goodwill property would add another 25 dwelling units.

The Master Plan and No Action Alternatives are compatible with the land use recommendations of the Bethesda-Chevy Chase Master Plan. Neither requires or applies pressures to change existing and future recommended land use and zoning. The NIH campus provides a buffer between the Bethesda CBD and residential communities to the north and west of the campus. Its presence reduces pressures to extend the CBD along Old Georgetown Road and Rockville Pike, which would occur if the property were privately held. Both alternatives are compatible with the Bethesda-Chevy Chase Master Plan and Bethesda CBD Sector Plan, which propose continuing R-60, RT-12.5 and R-10 land uses around the periphery of the campus, offering opportunities for non-vehicle home-work trips between NIH and the surrounding community.

The NIH Master Plan Alternative would not create planning or land use changes in the immediate environs of the campus.

5.1.3 Employment/Economic

Montgomery County is a major employment center for the metropolitan region and the State of Maryland. In 1999, there were 580,000 jobs in the County, exclusive of military employment (At-Place Employment Services, Maryland Department of Economic and Employment Development, 2001), a significant increase from 368,000 in 1991. Close to 60% of the County's employed residents work in Montgomery County. No other jurisdiction in the region employs so large a share of its own residents. Nevertheless, commuters from surrounding jurisdictions fill 42% of all jobs in the County. The County has 15% of all the jobs in Maryland and a similar share in the Washington metropolitan area (ibid.). The total number of jobs and number of private sector jobs in the County are larger than that for any other jurisdiction in Maryland.

Federal government employment continues to be an important component of the County's economic base. In 1990, about one in ten employees in the County worked for the federal Government. By 1997, this had decreased to a little over one in six. Nineteen federal agencies are located in the County. Because of Montgomery County's significance in the regional and State economic picture, important components of the local economic base are also important to the region and State.

Bethesda-Chevy Chase is an established but growing employment center. In 1988, the number of jobs in Bethesda-Chevy Chase (77,200) including the Bethesda CBD, exceeded the number of households (34,050). Many of these jobs were concentrated in the Bethesda CBD. The number of jobs in the

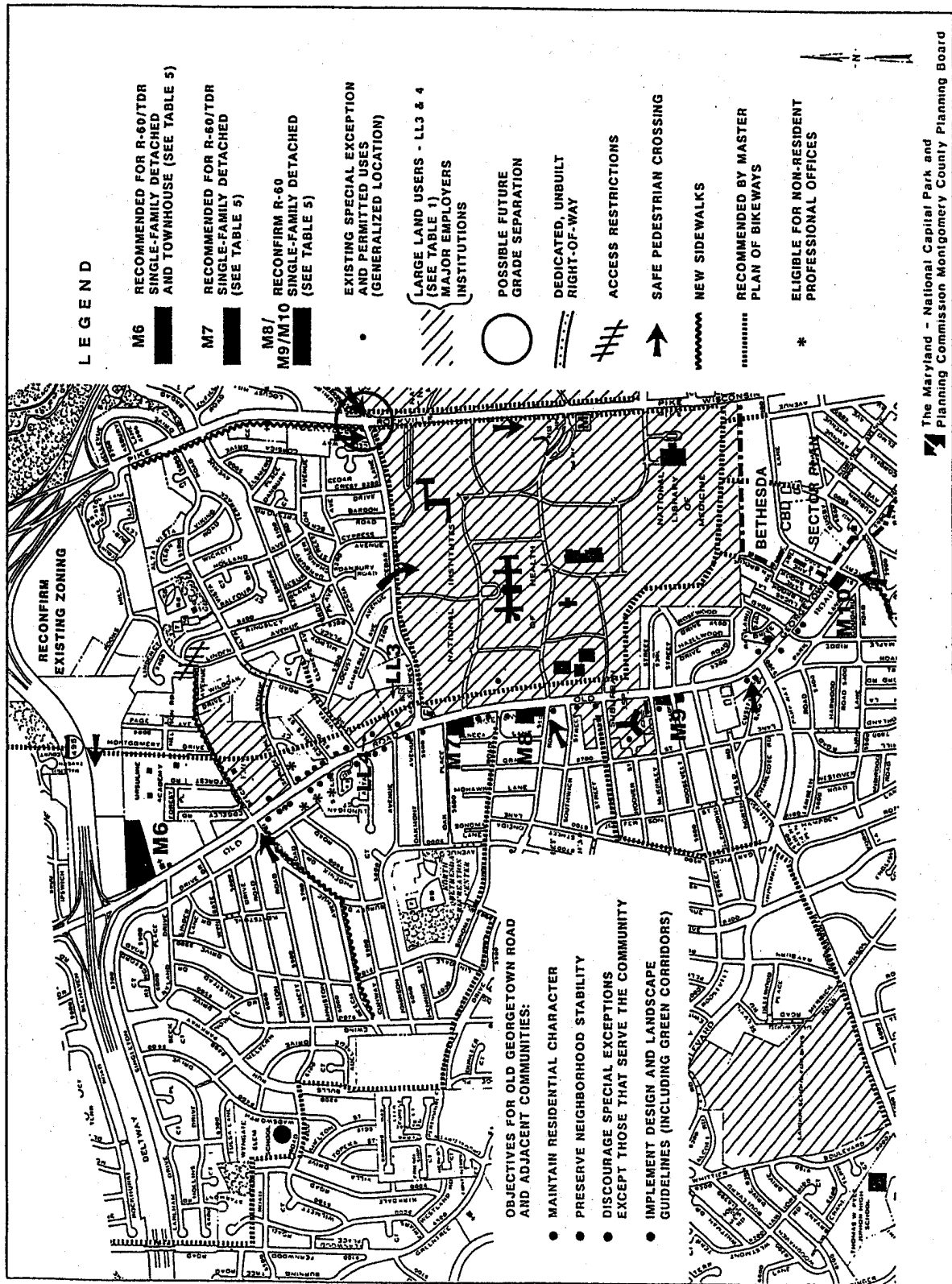


FIGURE 5-4 BCC MASTER PLAN RECOMMENDATIONS FOR OLD GEORGETOWN ROAD.

BCC Master Plan Site	Location	Size (acres)	Existing Use	Potential Use
—	Rockville Pike - Goodwill Property	---	Institutional	25 dwelling units
LL2a	Rockville Pike - Cedar Lane	34.6	Private School	111 dwelling units
LL3	Old Georgetown Road - Cedar Lane	3.9	FAES, Knights of Columbus	15 dwelling units
M1, a, b	Cedar Lane - Cypress Avenue	1.3	Vacant	5 dwelling units
M2	Cedar Lane - Cypress Avenue	2.1	Vacant	8 dwelling units
M3	Alta Vista Road - Locust Avenue	4.0	Farmhouse	16 dwelling units
M4, a, b	Alta Vista Road - Linden Avenue	5.8	Two houses	23 dwelling units
M7	Old Georgetown Road - Oak Place	1.7	3 houses and vacant lots	7 dwelling units
M8	Old Georgetown Road - Greentree Road	1.4	1 house, vacant lots	5 dwelling units
M9	Old Georgetown Road - McKinley Street	0.9	1 house, 3 vacant lots	3 dwelling units
TOTAL				218 potential units

*Note: Currently in the development approval process for 40 to 50 townhouses.
Source: Bethesda-Chevy Chase Master Plan, M-NCPPC, 1990

TABLE 5-1 POTENTIAL DEVELOPMENT SITES NEAR NIH CAMPUS.

Bethesda-Chevy Chase planning area in 2000 was 97,688. In 2000, NIH and the Naval Medical Center constitute the second largest employment center in Bethesda-Chevy Chase with a combined 24,350 employees.

The "moderate growth" scenario in the Master Plan for the Bethesda-Chevy Chase planning area envisioned 18,800 additional jobs by the year 2010. This includes 8,800 jobs in private developments already approved when the plan was adopted, leaving a potential for 10,000 additional jobs in the planning area. The plan states that such expansion should remain within the constraints of BCC transportation capacity.

Future job growth in the planning area is expected to be primarily shared among the three Sector Plan areas (Bethesda CBD, Friendship Heights, and Westbard) and the federal employment centers (NIH and National Naval Medical Center), with a small amount of additional job growth elsewhere. The 10,000 job level endorsed by the Plan contemplates only "moderate expansion" of federal facilities in the area. Much of the commercial development projected in the planning documents for the Bethesda-Chevy Chase planning area and its Sector areas has already occurred, but growth is expected to continue. The County FY 2003 Annual Growth Policy (AGP) tracks job growth attributable to projects currently in the development process pipeline. A total of 10,529 jobs of this type were given for Bethesda-Chevy Chase the Bethesda CBD, and Friendship Heights. An additional 12,300 such jobs were anticipated for pipeline developments in North Bethesda and White Flint.

Apart from stating that the largest concentration of employment in the Planning Area should continue to be the Bethesda Central Business District, the BCC Plan does not specify how new jobs are to be distributed among the three planning area employment centers. Instead, it anticipates that levels of job growth will be established through amendments to the Annual Growth Policy and to the three respective Sector Plans, based on considerations of community impacts and regional and local transportation capacity.

To support the overall level of employment growth anticipated, the plan calls for the County to take three key actions:

- Provide both significant expansion of transit and mobility services to BCC employment centers and moderate improvements to the highway system, especially in the more congested eastern part of the Planning Area.
- Stage the approval of new development to the availability of transportation capacity through the Annual Growth Policy.
- Locate new employment within existing employment centers and in areas with good transit service.

The Plan endorses two specific employment development objectives to maintain the BCC area contribution to the positive economic image of Montgomery County:

- Support the continuation of existing businesses within the Planning Area, including those that meet community retail and service needs.
- Recognize the importance of employment in the biomedical, medically related, and high technology areas.

In this way, the Plan acknowledges the key contribution made by NIH and the Naval Medical Command

to the Bethesda economic structure, as well as to the County's economy. It supports "some additional development to allow operational flexibility." The following provisions of the Plan are particularly relevant:

- The Central Business District should share any future traffic capacity for new development with the National Institutes of Health (NIH) and Naval Medical Command.
- NIH and NMC should share future BCC development with the Bethesda Business District. The largest additional development is likely to occur at the National Institutes of Health.
- Development levels must remain within the transportation system capacity constraints of the Bethesda-Chevy Chase area. More capacity could be achieved through a program of traffic reduction measures.

In the Bethesda CBD, the new Sector Plan recommends an overall development capacity envelope that would permit facilities for nearly 19,000 new jobs above the 1991 figure of 37,000, and up to 3,000 new housing units, largely apartments by 2010. Some of the parcels designated for employment are of substantial size and could accommodate office buildings of 100,000 sq. ft. or more. The Sector Plan is based on capacity and does not project employment or residential growth, which are totally contingent on market demand.

Federal Government employment in Montgomery County was 77,740 in 1997, amounting to 16.8 percent of all jobs in the County. NIH, with its work force of over 24,600 in the County, comprised somewhat over 31 percent of the federal total. Other health related agencies of the U.S. Public Health Service (the Food and Drug Administration, Health Resources & Services Administration, and Substance Abuse and Mental Health Services Administration) employed another 5,500 workers in the County. Seven different groups under the Department of Defense (including the Uniformed Services University of the Health Sciences and the National Naval Medical Center) employed 8,500; the Department of Commerce, 5,500; the Nuclear Regulatory Commission and the Department of Energy, together, somewhat fewer than 4,000. In 2001, NIH stood out as the largest single employer, public or private, in this community, where there are few large private employers.

NIH provides direct economic benefits to Maryland and Montgomery County. Historically, about 80 percent of the NIH budget devoted to biomedical research is spent extramurally through grants to institutions, companies, and scientists outside NIH. In Fiscal Year 2000, NIH spent 14.79 billion dollars on extramural research and training. Maryland continually ranks fifth among the States in receiving extramural program funding.

In Fiscal Year 2000, the various Institutes and Centers that comprise NIH awarded \$868.64 million to Maryland institutions and firms. Within this total \$595.29 million was expended on research grants, \$235.88 million on research and development contracts and \$30.4 million on researcher education and training. About \$19.4 million of the research grant funds were awarded through the NIH Small Business and Small Business Technology Transfer programs. The \$235.88 million Maryland received through R&D contracts was 21 percent of the NIH total \$1.123 billion awarded through the process. Most of the extramural expenditures went to three jurisdictions within the State; the City of Baltimore (\$561 million), and Rockville (\$130 million) and Bethesda (\$74 million) in Montgomery County.

Moreover, the presence of NIH in Montgomery County, along with the National Naval Medical Center, help to create a critical mass of health-related interests and support groups that, together, attract additional organizations and enterprises. According to the Montgomery County Office of Economic Development, over 50 associations in the health, bioscience and related technical fields have located in Montgomery

County, as have other institutions, such as the Howard Hughes Medical Institute and the American College of Cardiology.

A survey completed in 1993 indicated 62 of 135 biotechnology/medical companies in Maryland were located in Montgomery County (BIOMED: A Directory of Maryland Biotechnologies/Medical Companies and Organizations, 1992-93, Md. Dept. of Economic & Employment Development). This does not include facilities associated with the University of Maryland and Johns Hopkins University. Another roster, published by Montgomery County's Office of Economic Development in early 1992, identified yet 64 more biological and medical science-related industries in the community that were not included in the State's directory.

In 2000, Maryland's concentration of biotech companies ranks as the third largest in the nation, surpassed by only California and Massachusetts. The volume of product sales was estimated at more than \$4 billion. The number of biotechnology workers in these private companies is estimated at 5,000. Clearly, they produce for national and international markets, but NIH plays a role in attracting, training and stimulating the human resources so essential to the intellectual vitality of this health sector.

NIH staff and visitors are also an important component of the market for businesses in the Bethesda CBD. The several hotels host NIH-oriented conferences, visitors, Clinical Center patients and patients' families. Managers report a significant proportion of their room and conference business is NIH-related. Restaurants in the area rely on NIH-related business as a major source of patronage.

Discussion with NIH staff responsible for coordinating meetings and conferences indicates a sizeable number of such events involving large numbers of attendees. Many of these conference attendees are non-NIH employees from out-of-town who stay overnight in hotels, primarily those in the Bethesda area. In addition, both out-of-towners and local residents patronize area restaurants and convenience retailers in free time during these events, particularly when the conferences are held off-campus in area hotels.

Two of the Institutes furnished 1992 information on numbers of meetings and conferences, attendees, and estimates of numbers of hotel room nights used. The National Heart, Lung, and Blood Institute (NHLBI) held 36 meetings and conferences, typically lasting for one to three days during the year. A total of 1,000 people attended these meetings, an estimated half of them from out-of-town. NHLBI figures indicate approximately 1,000 hotel room nights were utilized as a result of these meetings.

The National Cancer Institute held 107 meetings and conferences, lasting from one to eight days, with most in the two-to-three-day range. Over 4,000 people attended these conferences, with an estimated 2,600 from out-of-town. NIH figures indicate approximately 3,800 hotel room nights were bought as the result of these meetings.

Under the 2003 Master Plan Update, the ability of NIH to administrate grants and awards will be more efficient. Since the sums are large, any small gain in capacity and efficiency would lead to indirect benefits to the State and County, which can be assumed to continue to receive their proportionate shares. The Master Plan Alternative would directly generate about a net 4,000 on-campus jobs over the next 20 years. While specialized researchers and clinical doctors are recruited nationally, most of these job opportunities will be filled from the regional work force.

The economic vitality of the Bethesda CBD and Bethesda-Chevy Chase planning area is essential. NIH influences the potential for economic growth in these areas through its traffic generation. NIH proposes mitigation measures in the Master Plan Alternative to control the levels of congestion at northern gateway intersections to the Bethesda CBD. NIH has set a goal of maintaining site generated AM and PM peak hour trips at May 1992 levels, adjusted for projects pre-approved at that time. These measures would

maintain available capacity at intersections around the campus for economic and housing development proposed in the Bethesda CBD Sector Plan and BCC Master Plan. Congestion will increase at intersections around the campus, but it will be due to general traffic growth associated with outside development.

In general, any increase in campus employee population as proposed in the Master Plan 2003 Update would generate a larger potential market for Bethesda CBD businesses. The Master Plan Alternative would locate more employees within eight minutes walking distance of the Medical Center Metrorail station, making them less hesitant to patronize Bethesda restaurants and businesses during midday.

In November 1991, the Montgomery County Executive issued a Strategic Plan for Economic Development in the 1990's. The plan calls for efforts by the County to retain and attract federal research and regulatory agencies, and to focus County private sector promotional efforts on expansion of knowledge-based industries and institutions. County officials regard biomedical research as a desirable clean or non-polluting "basic industry". They recognize the importance of NIH, both for its direct payroll and expenditures for supplies and services, and its expected ability to attract and foster biotechnology and related companies that will locate in the County. Considerable County resources, for example, have been devoted to establishing a life sciences center at Shady Grove near Gaithersburg. The Gaithersburg/Rockville area in which the center is located had 87 biotechnology companies listed in the County directory in 1993. The Master Plan Alternative would support this policy thrust.

The flow of research dollars, not to mention the intellectual capital generated by NIH activity, will lead to increases in employment and investment in these companies, new construction, and growth in the County's revenue base. NIH expenditures for vendors in the County to support the NIH's own operations can be expected to increase as well. NIH also would act as a stabilizing factor in the County economy.

5.1.4 Community Facilities

Community facilities in the vicinity of NIH are shown in Figure 5-5 and listed in Table 5-2.

The Stone Ridge School of the Sacred Heart is a private Catholic school for girls located to the southeast of the Rockville Pike/Cedar Lane intersection. School buildings are set back about 500 feet from Rockville Pike and 300 feet from Cedar Lane on a knoll which rises 40 to 50 feet above each street. The Convent of the Sacred Heart is located on the west side of the school. School grounds are bounded on the south by the National Naval Medical Center, and on the east by the Elmherst Parkway Neighborhood Conservation Area. Access is via Cedar Lane or northbound Rockville Pike.

Primary access to Stone Ridge is via two entrances on Cedar Lane, one to a parking lot adjacent to Cedar Lane, the other to parking and areas behind the school buildings. Egress in and out of the school entrances to and from the westbound lanes of Cedar Lane is difficult during the morning rush hour. Traffic on Cedar Lane waiting for the Rockville Pike signal queues beyond the entrances, and outbound vehicles from the school may have to wait several light cycles before they can enter the westbound traffic flow.

On the west side of Rockville Pike, the same phenomenon occurs at the Boy Scouts of America office building on the northwest corner of the intersection and adjacent residences on the north side of West Cedar Lane to the west. Outbound movements from the entrances to the eastbound lanes of West Cedar Lane during the evening rush hour must be made by a quick move into waiting queues of vehicles.

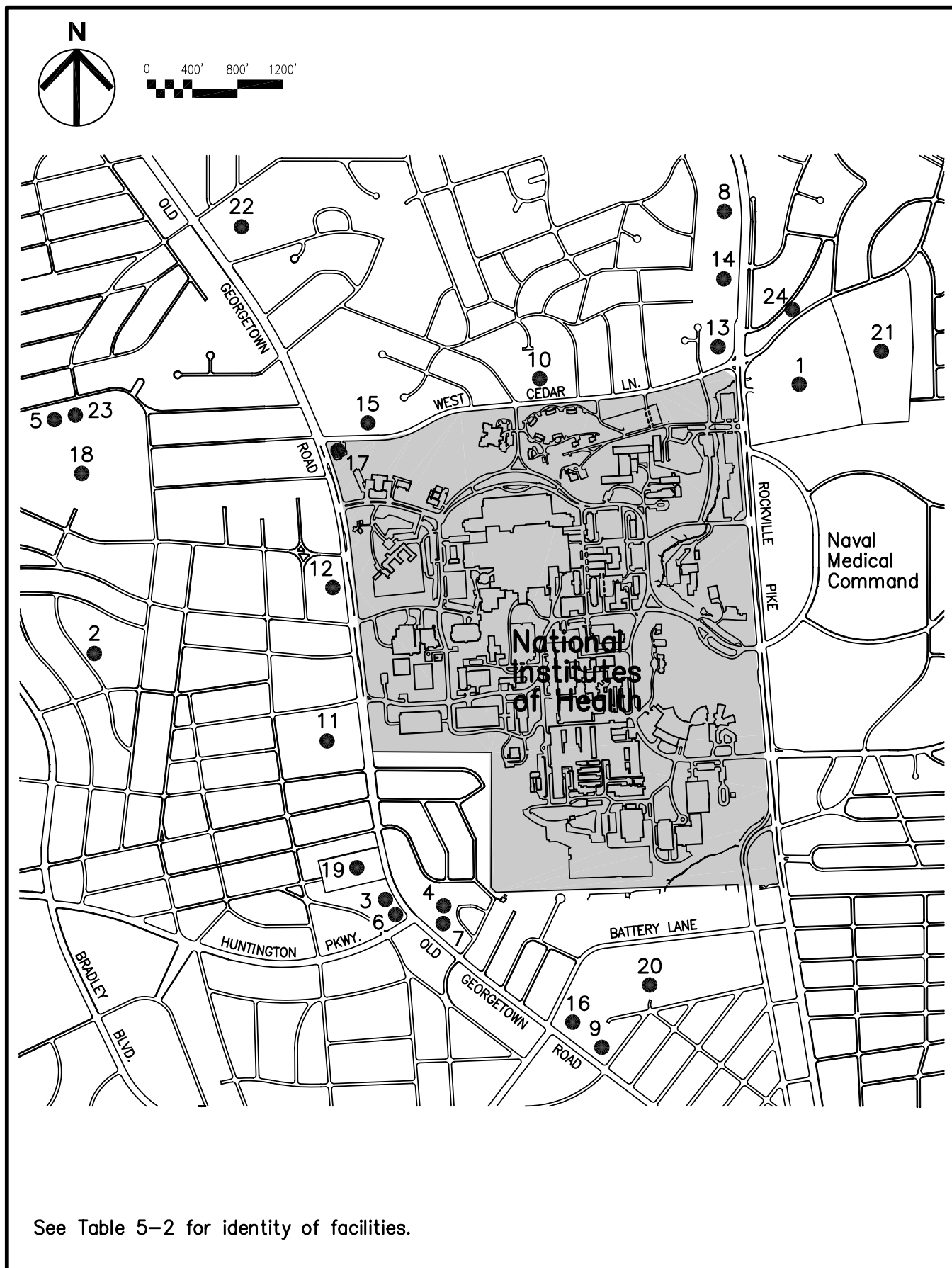


FIGURE 5-5 COMMUNITY FACILITIES.

School/Child Care Centers	
1	Stone Ridge School and Convent of the Sacred Heart
2	Bradley Hills Elementary School
3	Wesley Nursery School
4	Congregation Beth El Day Care
5	Ayrlawn Day Care Center
Religious	
6	Bethesda United Methodist Church
7	Beth El Temple
8	Temple Hill Baptist Church
9	Christ Lutheran Church
Health Care	
10	Carriage Hill Nursing Center
11	Suburban Hospital
Community Organizations	
12	Women's Club of Bethesda
13	Boy Scouts of America
14	Goodwill Industries
15	Knights of Columbus - Rock Creek Council
Emergency Response	
16	BCC Rescue Squad
17	Bethesda Fire Company No. 20
Parks and Recreation	
18	Ayrlawn Park
19	Greenwich Park
20	Battery Lane Park
21	Elmherst Parkway Neighborhood Conservation Area
22	Bethesda-Chevy Chase YMCA
23	Bethesda-Chevy Chase YMCA (Ayrlawn)
24	Rock Creek Park

TABLE 5-2 COMMUNITY FACILITIES.

Traffic movements in and out of the entrances to the Knights of Columbus and Foundation for Advanced Education in the Sciences (FAES) on West Cedar Lane just to the east of Old Georgetown Road are also difficult during the morning rush hour. However, most of the activities at these two facilities do not coincide with weekday morning peak period traffic conditions. Access to these facilities will continue to be difficult under traffic conditions generated by the Master Plan and No Action Alternatives.

The Bradley Hills Elementary School on Hartsdale Avenue is a Montgomery County public school serving the neighborhoods to the west of the NIH campus. Recreation facilities for local neighborhood use that are on the grounds of the school include tennis courts, play areas, and a ball field.

Child care centers in the area are incorporated within other community organizations. The Bethesda-Chevy Chase YMCA operates a child care facility on Oakmont Avenue in Ayrllawn. The Bethesda United Methodist Church and Beth El Temple are located at the intersection of Old Georgetown Road and Huntington Parkway to the southwest of the campus. Each has child care facilities, the Wesley Nursery School, and Beth El Day Care, respectively.

Child care center demand in the area is at a premium. For convenience, most parents seek child care facilities near their residence or work location. In the Master Plan Alternative, NIH proposes construction of two new centers, for NIH employee children. One would be in the Northwest Child Care Center, the other in renovated Building 34 (see Figure 4-2). Current child care center capacity on the campus is 183 children. The proposed Master Plan Alternative would increase the child care capacity to approximately 375 children.

The privately operated Phoenix Retirement Community occupies a high rise apartment building on Battery Lane on property abutting NIH's southern boundary. Suburban Hospital is a 310 bed regional general hospital with full emergency, diagnostic, and treatment facilities. The Carriage Hill Nursing Center is a 72 bed facility providing geriatric care for the elderly. None of these facilities are affiliated with NIH.

The R.A. Bloch International Cancer Information Center is located on the southwest corner of the Old Georgetown Road/West Cedar Lane intersection. The Center is part of the National Cancer Institute, and has the mission of preparing, publishing, and disseminating information on cancer detection and treatment. The building was built privately and purchased by NIH in 1982. Approximately 30 employees work in the building. The effects and impacts generated by the Center are included within the overall environmental analysis for the Bethesda campus.

NIH has attracted other private biomedically related organizations that have constructed facilities nearby. The Federation of American Societies for Experimental Biology occupies a large building on the west side of Rockville Pike about 0.4 mile to the north of the campus. The American College of Cardiology is located on the east side of Old Georgetown Road about one block north of NIH, and the American Association of Blood Banks is found two blocks south of the campus on Rugby Avenue in the Woodmont Triangle.

The Foundation for Advanced Education in the Sciences (FAES) maintains facilities on the northeast corner of the Old Georgetown Road/West Cedar Lane intersection. This is an independent private institution dedicated to education in the sciences, but many members are NIH staff. Each year, 3,000 students matriculate in the FAES School, which offers almost 200 courses. Most are in biomedical disciplines, but there is strong representation in the physical and behavioral sciences, English, and foreign languages.

Courses are at the undergraduate and graduate level and held in the evening. A majority of the faculty is composed of NIH staff, who share their special knowledge with a larger audience. Although courses are primarily oriented toward NIH scientific staff at all levels, the school is open to the public at large. Postgraduate medical courses are offered for Medical Board examinations and continuing physician education. The school also has a "Frontiers in Biology" program that provides high school biology teachers with information and assistance in classroom and laboratory teaching. Cooperative advanced degree programs with Johns Hopkins University and the University of Maryland are offered.

The National Naval Medical Center (NNMC) is located to the east of NIH in 75 buildings on a 232 acre site. About 8,000 military and civilians work in medical research, patient care, and advanced medical education at NNMC. Of 14 tenant activities at NNMC, the Bethesda Naval Hospital is the largest. The

primary mission of the hospital is medical care and treatment of active duty military personnel, dependents, and retired military on a space available basis. High level government officials such as the U.S. President and Vice President, their families, members of Congress, Supreme Court Justices, as well as foreign embassy personnel, are beneficiaries of medical service at the Naval Hospital. The Naval Hospital is a ten building complex with the most notable building being the original hospital tower that serves as a local landmark. The center hospital has over 427 beds and is expandable to 779 beds, if a local or regional catastrophe occurs. It has 50 clinics that treat more than 2,500 outpatients daily. More than 3,300 are employed at the hospital.

The Uniformed Service University of the Health Sciences (USUHS) provides a complete medical education to students, who obligate themselves to a fixed term of military service as medical doctors in return, and ongoing training of military service medical personnel. In addition to doctorates in medicine, the USUHS offers graduate level degrees in biochemistry, microbiology, pharmacology, and other biomedical sciences. The University is open to personnel from all the military services. A full range of university facilities is contained within the 500,000 square foot facility. It has 1,200 employees and students.

Other NNMC tenant activities include the Naval Medical Research Institute, which performs research on diseases and occupational health concerns of sailors and Marines; the Naval Dental Center, the Naval School of Health Sciences, the Armed Forces Radiobiology Research Institute, Naval Dosimetry Center, Naval Health Sciences Training Command, and the Naval Medical Research and Development Command.

The nearest Montgomery County Police station is located in the Bethesda CBD. NIH has its own campus police force, but its enforcement jurisdiction is limited to the NIH property.

Other County emergency response facilities in the vicinity of NIH are the Bethesda Fire Company No. 20 located at the northwest corner of the campus, and the BCC Rescue Squad at the intersection of Old Georgetown Road and Battery Lane. The NNMC also has a fire station. NIH maintains its own fire department and hazardous incident response unit, which have a fire truck, emergency response truck, and ambulance. They are the primary and first responders to incidents on the campus, and cooperate as second responders to the County and NNMC. Each year, the NIH Fire Department and Emergency Response Unit responds to about 200 calls from the County and NNMC.

The neighborhoods surrounding NIH are mature and stable. There is little room for additional housing. NIH employees who purchase or rent housing in the immediate vicinity will replace residents in existing housing, and not place new demands on community facilities. New housing proposed for the Bethesda CBD and Bethesda-Chevy Chase and North Bethesda planning areas will be built over the next 20 years regardless of NIH growth, because there is sufficient demand created by proposed job development in the above planning areas to sustain housing demand without NIH growth. NIH employees who move into new housing will be indistinguishable from the general resident population as far as community facility impacts are concerned. No impacts are expected on community facilities as a result of growth in campus population.

5.1.5 Housing/Population

Eight residential neighborhoods are located around the periphery of NIH (Figure 5-6). These include Maplewood, Ayrilawn, Sonoma, Huntington Terrace, Edgewood/Glenwood, East Bethesda, and Locust Hill as defined by citizen association boundaries. These neighborhoods are predominantly composed of single family detached homes on relatively compact lots of a quarter acre or less. The

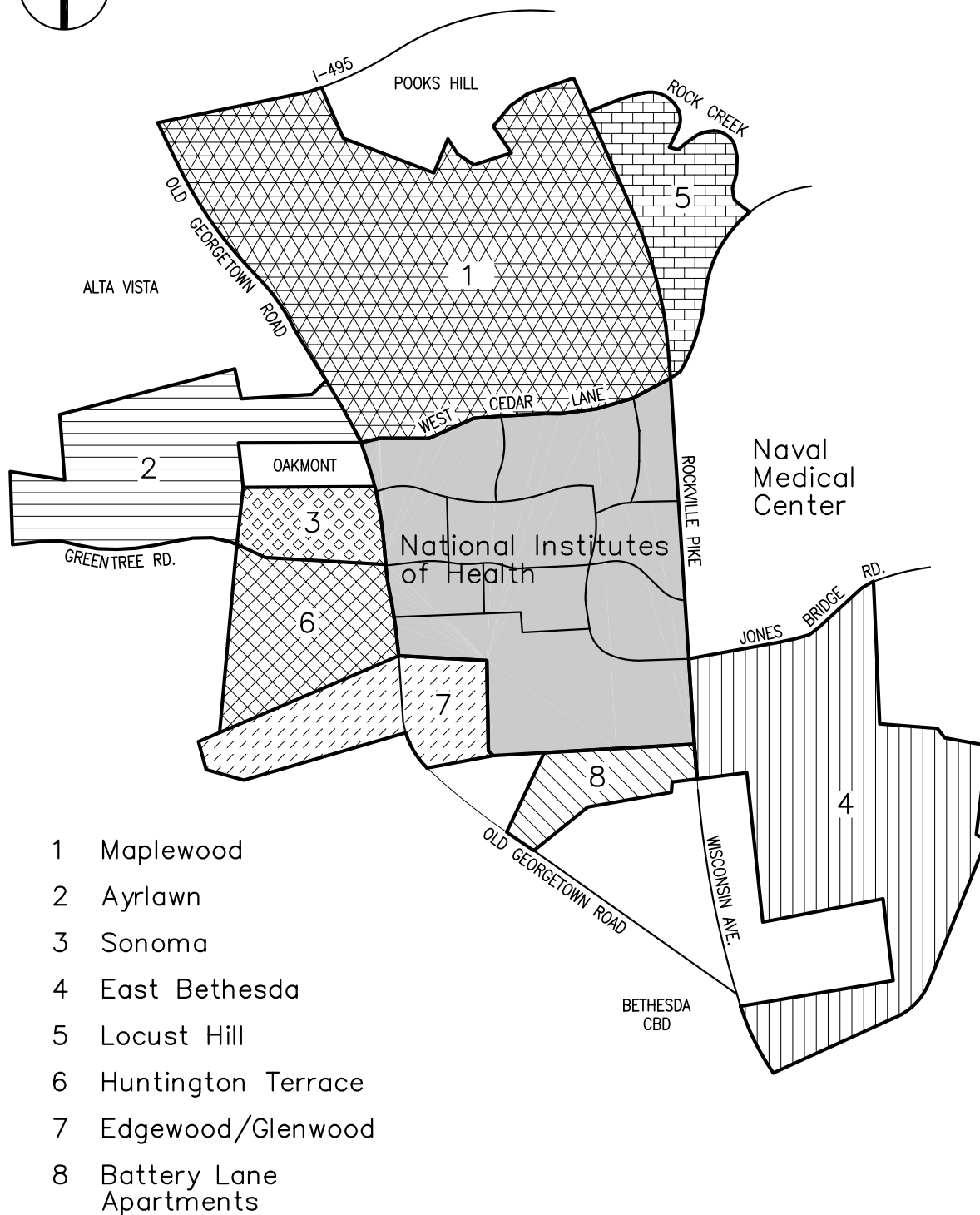


FIGURE 5-6 NEIGHBORHOODS IN THE NIH VICINITY.

eighth neighborhood, Battery Lane, is composed of high and midrise apartments and condominiums in the Bethesda CBD on the south side of the campus. Census tracts in which the neighborhoods lie are shown in Figure 5-7. Although the tracts cover larger areas, data is still indicative of neighborhood conditions.

Residential neighborhoods in the vicinity of NIH have been established for nearly half a century. The oldest homes not associated with the original farmsteads date from about 1900 when summer cottages were built in the area by District of Columbia residents (Table 5-3). A smattering of residences in Huntington Terrace and Alta Vista date from this period. The small neighborhood of Oakmont was once the site of a short-lived amusement park that was popular at the turn of the 20th century. These early homes were supplemented over the years by a varied assortment of homes. Among the single family neighborhoods, East Bethesda, with its convenient access to the Bethesda commercial area, was the earliest of the communities to develop fully. Most development occurred between the mid-1930s and mid-1950s. Development of NIH and the Naval Medical Center shortly before and after World War II triggered rapid growth in the neighborhoods to the north and west of NIH. The older homes were constructed around the NIH campus and on tracts adjacent to the major roadways where development was essentially complete by the 1960s. Later development within the tracts fanned out to the north and west.

The large number of units constructed in the 1970's in tract 44.02 is attributable to the Pooks Hill Apartments and other apartment and condominium construction on the north side of the tract. There are isolated pockets of new construction on undeveloped or recycled parcels such as a former school site, Trafton Place, in Ayrilawn.

The area of Bethesda surrounding NIH was not subject to large tract construction with only a few home models as seen in much of suburbia. It is filled with an eclectic assortment of housing styles and sizes set on narrow, tree lined streets. These varied houses, with their convenient location to employment areas, shopping, amenities, and excellent schools, command sales prices in the upper price ranges for their respective size and categories (Table 5-4). Although the average single family home value ranges from \$250,000 to \$500,000 in respective neighborhoods, the homes tend to sell quickly when they come on the market. New homes built singly or as a few units sell for more than \$600,000.

About two thirds of the detached residences are family occupied with the remainder occupied by one or more individuals without children. About two-thirds of the detached units are owner occupied. Demand created by NIH employees in large part support available rental properties. Vacancy rates were reported at less than 4% in the 2000 census. Future growth in housing is expected to be low, less than 2 to 3% of the existing stock.

Tract 48.01 to the south of NIH differs significantly from the other neighborhood areas. Here, rental apartments predominate. Mid and high rise apartment complexes line both sides of Battery Lane for its entire length between Woodmont Avenue and Old Georgetown Road. Older mid-rise units built after World War II are found in the eastern sector. They include the Glen Lane, The Glendorra, The Glenmont, The Glenbrook, Glenwood, and the Glen Aldon that are operated under one central management company. Other complexes include Camelot Mews, Cambridge Square, the Battery Lane apartments, and the newer high rise Madison Park, Whitehall Condominium and Middlebrook complexes. Over 875 units are located in the 12 complexes along Battery Lane, providing a major source of affordable housing in Bethesda. In contrast to the single family neighborhoods, nine out of 10 properties in Tract 48.01 are rented, and nearly three-fourths of the units are non-family occupied.

Population characteristics reflect the neighborhood development patterns (Table 5-5). Many residents moved to the area when it developed 40 to 50 years ago, and are now in their seventies. There was also a large influx of families into the area 25 to 30 years ago when the area became more urban oriented. Their

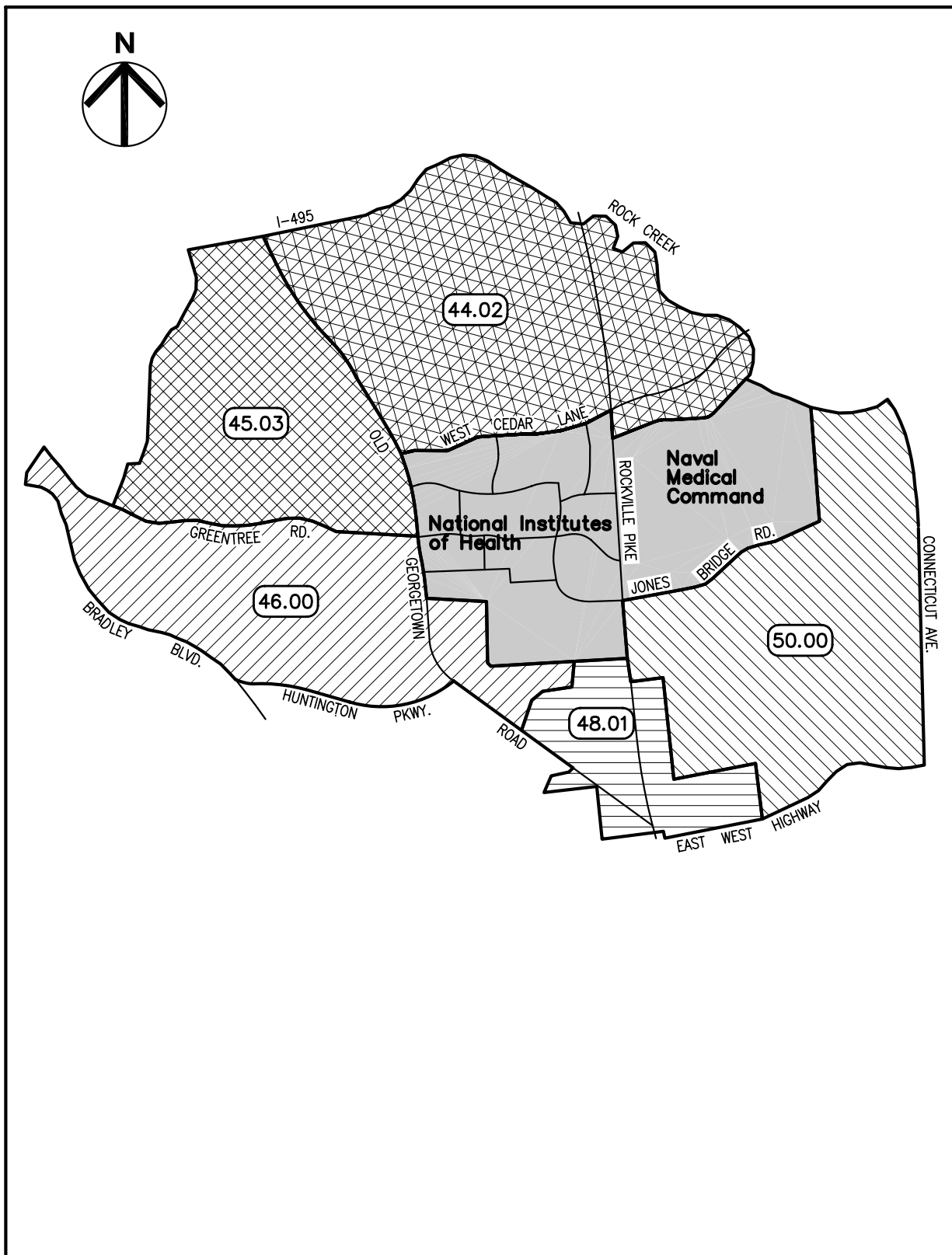


FIGURE 5-7 U.S. CENSUS TRACTS.

Housing Units Years Built	Montgomery County	Census Tracts					Total Vicinity
		44.02	45.03	46.00	48.01	50.00	
1999-March 2000	6,863	7	8	0	13	30	58
1990-1998	42,064	522	35	26	628	292	1,503
1980-1989	77,758	419	18	89	171	87	784
1970-1979	62,152	925	27	102	325	130	1,509
1960-1969	61,402	384	127	532	602	199	1,844
1950-1959	46,801	826	592	672	344	250	2,684
1940-1949	21,002	224	433	492	189	462	1,800
pre-1939	16,590	76	135	271	66	418	966
Total	334,632	3,383	1,375	2,184	2,338	1,868	11,148
Source: 2000 U.S. Census							

TABLE 5-3 AREA HOUSING UNITS AND PERIOD BUILT.

children have reached adulthood and gravitated elsewhere resulting in fewer children under 18 in the neighborhoods than in the County as a whole. There is a significantly higher proportion of residents over 65 than in Montgomery County as a whole, particularly in Tracts 44.02 and 50.00 to the north and east of the campus. Data for Tract 44.02 is influenced by the Carriage Hill Nursing Home.

Increasingly, however, the older residents are being replaced by younger professional couples, often childless or with one child. These younger couples frequently make substantial renovations and alterations to the older and smaller homes. Turnover and renovations have recently increased as the original owner cohort ages. This phenomenon is most evident in the East Bethesda neighborhood (Tract 50.0), which shows a significant decline in the elderly, but only the initial phases of growth in those under 18.

Population characteristics along Battery Lane are quite different. Forty-nine percent of the population lives in high rise apartments and condominiums, 38 percent in garden apartments. More than sixty percent of the population lives alone, and families occupy only 23 percent of the units. About 60 percent of the population is female and many of these are elderly.

The resident population is extraordinarily well educated with 27.8 percent holding bachelor's degrees and an additional 36.8 percent earning advanced graduate or professional degrees. NIH scientists and physicians among this resident population have a significant influence on these percentages.

Among all counties in the U.S., Montgomery County has consistently ranked in the top 10 in terms of median household or per capita income on a national basis. In 1999, the median household income in the

	Montgomery County	PCT.	Census Tract									
			44.02	PCT.	45.03	PCT.	46.00	PCT.	48.01	PCT.	50.00	PCT.
Housing Units												
Total	334,632	100.0%	3,383	100.0%	1,375	100.0%	2,184	100.0%	2,338	100.0%	1,868	100.0%
Occupied	324,565	68.7%	3,283	97.0%	1,338	97.3%	2,123	97.2%	2,246	96.0%	1,829	97.9%
Owner Occupied	223,017	31.3%	2,220	67.6%	1,140	85.2%	1,513	71.3%	284	87.4%	1,143	62.5%
Renter Occupied	101,548	68.7%	1,063	32.4%	198	14.8%	610	28.7%	1,962	24.9%	686	37.5%
Family Occupied	225,193	69.4%	1,600	48.7%	995	74.4%	1,327	62.5%	559	75.1%	944	51.6%
Non-family Occupied	99,372	30.6%	1,683	51.3%	343	25.6%	796	37.5%	1,687	48.4%	885	48.4%
Household Composition												
1 Person	79,298	24.4%	1,420	43.2%	277	20.7%	641	30.2%	1,416	63.0%	708	38.7%
2 Person	102,141	31.5%	1,113	33.9%	478	35.7%	712	33.5%	662	29.5%	598	32.7%
3 Person	54,999	17.0%	317	9.7%	265	19.8%	353	16.7%	102	4.5%	246	13.4%
4 Person	51,112	15.7%	268	8.2%	223	16.7%	280	13.2%	58	2.6%	175	9.6%
5 Person	23,088	7.1%	115	3.5%	72	5.4%	113	5.3%	8	0.4%	75	4.1%
6+ Person	13,927	4.3%	50	1.5%	23	1.7%	24	1.1%	0	0.0%	27	1.5%
Owner Occupied Housing Unit Value												
Lower	\$158,900		\$263,500		\$249,300\$		\$280,600		\$310,700		\$239,000	
Quartile	\$221,800		\$327,900		294,500		\$335,700		\$364,300		\$296,000	
Median Value	\$336,400		\$404,700		\$371,600		\$387,900		\$438,500		\$370,100	
Upper Quartile												
Contract Rent (Monthly)												
Lower Quartile	\$711		\$847		\$1,046		\$859		\$788		\$1,246	
Median Value	\$856		\$1,069		\$1,303		\$1,097		\$941		\$1,972	
Upper Quartile	\$1,054		\$1,403		\$1,573		\$1,675		\$1,262		\$2,000*	
* \$2,000 is upper limit recorded by U.S. Census. Actual value exceeds this limit by undetermined amount. Source: U.S. Census, 2000												

TABLE 5-4 HOUSEHOLD CHARACTERISTICS.

	Montgomery County	PCT.	CENSUS TRACT									
			44.02		45.03		46.00		48.01		50.00	
			PCT.		PCT.		PCT.		PCT.		PCT.	
Population	873,341		6,638		3,491		4,987		3,417		4,616	
Race												
White	565,719	64.8%	5,563	83.8%	3,068	87.9%	4,320	86.6%	2,627	76.9%	4,008	86.8%
Black	132,256	15.1%	159	2.4%	98	2.8%	93	1.9%	177	5.2%	218	4.7%
American Indian	2,544	0.3%	11	0.2%	13	0.4%	9	0.2%	8	0.2%	6	0.1%
Asian	98,651	11.3%	583	8.8%	225	6.4%	445	8.9%	400	11.7%	182	3.9%
Hispanic Origin	100,604	11.5%	366	5.5%	165	4.7%	255	5.1%	252	7.4%	331	7.2%
Other or 2 or more	74,589	8.5%	322	4.9%	87	2.5%	120	2.4%	205	6.0%	202	4.4%
Age												
Median Under 5	36.8	6.9%	43.4	4.7%	38.3	8.0%	39.4	7.1%	34.6	2.3%	38.5	6.3%
Under 18	60,173	25.4%	312	16.3%	280	24.4%	355	22.4%	80	7.4%	289	13.7%
65 & Over	221,758	11.2%	1,079	23.1%	851	13.1%	1,118	15.1%	252	13.2%	634	21.6%
	98,157		1,533		458		752		450		995	
Median Household Income*	\$71,551		\$84,161		\$109,765		\$92,754		\$53,667		\$83,179	
* 1999 Census Data Source: U.S. Census, 2000												

TABLE 5-5 POPULATION CHARACTERISTICS.

County was \$77,551. This was double the national median income of \$35,500. The single family neighborhoods around the campus are consistently higher than this County figure despite the comparatively high proportion of retired persons. Many households have two wage earners. The 1996 median household income for the Bethesda-Chevy Chase planning area was \$95,480 with 47.7 percent of households having incomes greater than \$100,000.

The Bethesda-Chevy Chase Master Plan proposes 4,010 additional housing units by the year 2010 including 2,675 units that were already approved when the plan was adopted in 1990. The Bethesda CBD Sector Plan estimates that there is capacity for an additional 3,000 units in the CBD. Most of these are apartments. It is estimated that 375-500 units could be phased-in annually. Areas adjacent to the NIH campus have a potential capacity for 218 dwelling units, if developed (see Table 5-1). The County does not encourage development of these sites but would permit residential development on them.

North of the Beltway, the North Bethesda planning area anticipates construction of several thousand dwelling units, primarily apartments and townhouses, in the 1990-2010 period, including some 1,250 apartment and townhouse units projected for Rock Spring Park near Montgomery Mall. Many of the units proposed for North Bethesda are near Metrorail stations such as Grosvenor, White Flint, and Twinbrook.

NIH has about 17,500 employees on the Bethesda campus and about 10,400 of them live in Montgomery County. About 11 percent of them live in Bethesda, Chevy Chase, Cabin John and Kensington, and 850 reside in Gaithersburg and Germantown. Housing demand created by routine employee turnover and retirement is an important element in sustaining housing demand in Montgomery County, and this effect increases as one gets closer to the campus.

Under the Master Plan Alternative, the campus employee population would increase to about 22,000 by 2023. No noticeable impacts on housing demand or prices are expected from implementation of the Master Plan. Except for recruited clinicians and scientists, it is probable that many new employees would come from the Washington regional work force. Many of the new hires would be looking for residences in the area. With the passage of time, they would become part of the regular NIH work force, increasing the annual volume of employee turnover and retirements, and adding to the local housing demand.

About 1,000 of the NIH employees at the Bethesda campus are researchers in training and visiting scientists assigned temporarily to NIH. These groups stay at NIH Bethesda for periods ranging from a few weeks to several years. Proximity of residence to NIH is desirable for these personnel. If regional transportation management measures are implemented over the next decade, then shorter distances between work and home, and residential locations near Metrorail, become more desirable.

The turnover from such a large transient work force at NIH, coupled with the reduced work-home travel distance, will contribute to sustaining the strong rental housing market in the areas surrounding the Bethesda campus and in the Red Line corridor in both the Master Plan and No Action Alternatives.

At the same time, houses in the Bethesda area are among the higher priced in a high price housing area. As turnover continues, housing and rental values will likely continue to be maintained or increase. The neighborhoods surrounding the campus have few vacant sites for new single family housing of more modest value. Professional salaries are sufficiently high to bring these units within reach of many staff members, but affordability of housing in the immediate vicinity may become an increasing problem for junior and non-professional personnel. NIH employees generally earn less than their counterparts in the private sector. It is expected that the housing market in Bethesda and North Bethesda will become even more competitive as the number of jobs in the private sector along the Red Line corridor increases, and regional transportation management measures take effect.

5.1.6 Economic Analysis

Costs associated with master plans are indeterminate for three reasons. First, master plans are conceptual by nature and do not give specificity to dimensions and materials needed to determine costs. This permits flexibility for future planners and designers. Second, master plans are long term. The NIH Bethesda campus Master Plan covers a twenty year period, and estimates of implementation costs beyond currently budgeted items would be speculative. And third, the Master Plan is presented as an envelope for development, and all projects may not be implemented. The benefit of modernizing NIH facilities to improve research efficiency and capability on campus, and to improve efficiency in administering off campus or extramural research, and thus improve the health and quality of life of the American people is undeniable, but unquantifiable.

Implementation of the Master Plan Alternative will be of overall benefit to the Montgomery County economy. Through its Transportation Management Plan (TMP) goal of maintaining NIH generated peak hour trips at May 1992 levels, NIH reserves traffic capacity for development in the Bethesda Central Business District and Rockville Pike corridor. Development proposed in the Bethesda-Chevy Chase Master Plan and Bethesda CBD Sector Plan can continue unabated by NIH Master Plan facilities and growth. The rate of growth proposed at NIH is less than that for the Bethesda CBD.

NIH creates significant direct and indirect benefits throughout the U.S. and in Maryland (The Economic Impact of the NIH in Maryland and the U.S., Maryland Dept. of Economics and Employment Development, 1994). Among the States, Maryland is the principal beneficiary of NIH due to receiving the bulk of NIH direct intramural program expenditures (Table 5-6). In Fiscal Year 1993, NIH contributed about \$1.7 billion directly to the Maryland economy. About two thirds of this amount was attributable to employee salaries and fellowships and intramural program service contracts awarded to Maryland firms. NIH also expended near \$550 million in Fiscal Year 1993 in support of extramural research in Maryland by others outside NIH. Maryland ranked fourth in the nation behind California, New York, and Massachusetts in total research grants and expenditures awarded by NIH in FY 1993. The Johns Hopkins University in Baltimore was the largest single recipient of NIH extramural research grants and contracts in the U.S. In FY 1993, the university received over \$259 million (ibid).

Direct expenditures by NIH in its intramural and extramural programs lead to secondary and tertiary indirect economic benefits as funds received directly are subsequently paid to other parties. The total or overall annual economic impact of NIH in Maryland is estimated to be \$36 billion in gross sales, \$1.9 billion in employee income, and about 62,900 jobs when these indirect effects are taken into account. The intramural program represents about 60 to 65 percent of this economic benefit (ibid).

It is estimated that, in FY 1993, NIH spending generated a total of \$70 million in personal income tax receipts, \$35 million in local County personal income taxes, and \$17 million in State retail sales tax receipts in Maryland. The combined State and local tax receipts from direct and indirect NIH activities in Maryland were estimated at \$122 million (ibid).

NIH on-campus growth will have positive economic benefits for commercial enterprises in Bethesda by providing a larger concentrated potential market. The Master Plan and TMP implementation will make NIH employees less hesitant to patronize Bethesda restaurants and businesses during midday by locating more employees within five minutes walking distance of the Medical Center Metrorail station, where there are now less than 1,000 on the campus in that situation. NIH creates a high demand for overnight accommodations through the large number of technical meetings and conferences held on the campus. NIH's effect on residential property values cannot be estimated with precision, but NIH has a positive effect. In Montgomery County, the most important factors in determining property values are location

<u>Intramural</u>		
Business Services	\$80.4	
Equipment Rental and Leasing	47.5	
Construction	45.4	
Scientific Instruments	40.9	
Chemicals and Allied Products	25.5	
Transportation, Communications Utilities	24.7	
Computer and Data Processing Services	21.4	
Wholesale and Retail Trade	19.9	
Printing and Publishing	19.7	
Miscellaneous Office Machines	13.7	
Other Services	15.2	
Miscellaneous Obligations	12.1	
	Total Intramural Contracts	\$366.5
	Salaries and Fellowships	\$785.0
	Total Intramural Program	\$1,151.5
<u>Extramural</u>		
Colleges, Universities, Biomedical Industry	\$460.2	
Computers and Data Processing Services	37.5	
Management and Consulting	30.0	
Other Services	16.6	
Miscellaneous Obligations	5.4	
	Total Extramural Program	\$549.7
	Total Direct Maryland Expenditures	\$1,701.2
Source: <u>The Economic Impact of the National Institutes of Health in Maryland and the U.S.</u> , Maryland Dept. of Economic and Employment Development, 1994.		

TABLE 5-6 NIH DIRECT ECONOMIC IMPACT IN MARYLAND IN FISCAL YEAR 1993 (in millions of 1993 dollars).

and school district. Neighborhoods in the vicinity of NIH rank high in both categories. About 1,600 of the 17,500 NIH employees live in Bethesda, Chevy Chase, and Kensington. Housing demand created by routine NIH employee turnover and retirement is an element in sustaining housing demand and prices in these areas, and this effect increases as one approaches the campus based on a distribution analysis of employee population.

Americans move on the average of once every five years. NIH has long term permanent employees, but about 20% are transient research trainees and visiting scientists assigned to NIH for only a few months or years. Conservatively, if it is assumed that NIH employees move residences once every ten years, and the distribution of employee residences are similar to current ones, then NIH employees constitute a market for about 970 residences per year in Montgomery County, and 180 residences per year in Bethesda, Chevy Chase, and Kensington. Increases in campus population would increase proportionately the NIH employee demand for housing in the immediate area. Other factors will increase the pressure to make residential proximity to the campus more desirable for NIH employees. Regional and NIH transportation management will discourage single occupant vehicle use. Increasing long term regional traffic congestion will place greater emphasis on living closer to work.

Growth has been relatively continuous at NIH for nearly 50 years. The Montgomery County property tax

records for the neighboring communities were searched to determine if there was any decrease in property values as one drew closer to the campus or as a result of these projects. Comparisons between neighborhoods cannot be made because of differing housing types and lot sizes, but within neighborhoods comparisons of 1992 and 1994 records indicated no evidence of decreasing land, improvement, or assessed property values as the distance to the campus decreased. Property values abutting the campus had little variance from those one or two blocks from the campus. Generally, properties abutting the campus had higher values.

The quality of life on the NIH campus is important to NIH as well as the surrounding neighborhoods. NIH must compete with other institutions for researchers, and government salaries are generally less than in the private sector. A high quality campus setting is an important factor in attracting researchers and highly qualified technical support personnel. One of the fundamental purposes and goals of the Master Plan is to enhance the quality of life and character of the campus. This fundamental tenet influences all aspects of the plan from the broad scope of functional layout of buildings and quadrangles, to the minor details of landscaping, signing, and lighting. The internal quality and character of the campus cannot be separated from the character of the campus as perceived and experienced from the surrounding neighborhoods. The Master Plan has incorporated a number of mitigation measures to maintain or enhance the quality of life in surrounding neighborhoods. These include measures to maintain NIH generated traffic at May 1992 levels, maintain and enhance the buffer zone around the campus, reduce construction, lighting, noise, and air quality impacts.

5.1.7 Environmental Justice

Presidential Executive Order 12898, issued on February 11, 1994, requires federal agencies to identify and address, as appropriate and that are generated in the undertaking of its activities to the greatest extent practicable, disproportionately high and adverse human health or environmental effects of its activities on minority or low income populations to the greatest extent practicable.

Based on the data given in Sections 5.1.4 and 5.1.5, the project area contains no identifiable minority or low income communities or neighborhoods composed of predominantly minority or low income populations, and no environmental justice impacts are expected.

5.2 PARKS AND RECREATION

Four parks owned and operated by M-NCPPC, Montgomery County Department of Parks, are located in the vicinity of the NIH campus.

- Rock Creek Park

In Maryland, Rock Creek Park is a regional Montgomery County park that serves County-wide outdoor recreation needs, and conserves national resources. It protects Rock Creek watershed stream valleys, floodplains, and wetlands. It is the second largest park in the County system, encompassing 1,795 acres. Arms of the park follow branches of the creek into numerous residential neighborhoods. For nearly 10 miles, the park follows the meanders of Rock Creek from the District of Columbia boundary to Route 28 east of Rockville. It continues above Route 28 to the headwaters of Rock Creek as the Upper Rock Creek Regional Park. The park continues southward from Montgomery County through the District of Columbia to the Potomac River. The section within the District is owned and operated by the U.S. National Park Service.

The park is a critical element within the County park system. Large areas remain undeveloped. Active

recreation facilities in the form of ball fields, picnic areas, tennis and basketball courts, and lakes are interspersed throughout the park. All are linked by a trail and bike path system.

The closest point of approach for the main stem of the park to NIH is about 0.6 miles from the northeast corner of the campus. However, a small tongue or spur of the park extends through the Locust Hill Estates to the northwest corner of the Rockville Pike/West Cedar Lane intersection. This spur is an important access route between Bethesda and the main stem of Rock Creek Park. The NIH Stream flows through this section of the park after it leaves the campus.

The Elmhurst Parkway Neighborhood Conservation Area is located on the east side of Stone Ridge School. It is a natural area dedicated to watershed protection and open space preservation with no recreation facilities. Local residents use it for walking and nature study. The 22.7-acre property is included in the Rock Creek park system by the M-NCPPC Department of Parks.

- Battery Lane Urban Park

This park is a small 2-acre green oasis located amid the urban high rise and garden apartment complexes on Battery Lane. It is 600 feet long and from 50 to 200 feet in width, extending from the intersection of Norfolk and Rugby Avenues at its south end to Battery Lane. It has a tennis court, a basketball court, and a tot lot or child play area. A bike path or trail courses the length of the park. This path extends to the south side of the NIH campus through a narrow right-of-way between the Glen Lane and Phoenix apartments. It serves as a popular pedestrian access route between the NIH campus and the Bethesda CBD via the Woodmont Triangle.

The Bethesda CBD Sector Plan recommends an increase in recreational uses at this park by installing improvements to increase park access and visibility. Landscaping and seating could be added to serve workers from the Woodmont Triangle and adjacent residents. The trail through the park would be extended along Glenbrook Parkway to tie into the regional CBD bike path system.

- Ayrlawn Park

Ayrlawn Park is a 20.4-acre park located two blocks to the west of the Old Georgetown Road/West Cedar Lane intersection. It is classified as a local park that provides facilities for programmed or organized recreation. Facilities include an adjunct to the Bethesda YMCA Program Center with community meeting rooms, child care and gymnastics centers; fenced and unfenced play areas, four tennis courts, and soccer, softball, and regulation and Little League baseball fields.

- Greenwich Park

This 2.8-acre neighborhood park is located on the west side of Old Georgetown Road about three blocks south of the campus. It has facilities for informal leisure activities. Two tennis courts, a basketball court, gazebo, play area, benches, and picnic table can be found in the eastern half of the park. The western half is covered by well maintained open woods and lawn. The rear yards of residences on Glenwood and Custer Roads overlook the park to the north and south.

In addition to M-NCPPC Department of Parks facilities, two other recreational facilities are present.

- YMCA

The Bethesda-Chevy Chase YMCA is located four blocks to the north of the campus on Old Georgetown Road. Facilities include tennis courts, swimming pool, soccer field, outdoor track and a recreation center.

The Master Plan and No Action Alternatives would not create significant direct or indirect negative impacts on M-NCPPC park facilities, the YMCA, or their respective recreational values.

5.3 TRANSPORTATION

5.3.1 Road Network/NIH Access

Rockville Pike (Maryland Route 355), Old Georgetown Road (Maryland Route 187), Jones Bridge Road and West Cedar Lane are the primary access routes to the NIH Bethesda campus. Rockville Pike is identified as Wisconsin Avenue to the south of Woodmont Avenue in the Bethesda CBD. The I-495 Capital Beltway passes about 0.7 miles to the north of the campus and has interchanges with Rockville Pike and Old Georgetown Road. A spur of I-270, which passes through Montgomery County to the northwest, joins the Capital Beltway at the Rockville Pike interchange.

Rockville Pike is a six-lane divided roadway providing access to the study area from I-270, the Capital Beltway, and a heavily developed Montgomery County corridor from Rockville to Gaithersburg to the north. To the south, Rockville Pike is the main road through the Bethesda CBD before it reaches the District of Columbia. Rockville Pike forms the eastern boundary of NIH. There are signalized intersections with Cedar Lane/West Cedar Lane, Jones Bridge Road/Center Drive, and Woodmont Avenue in the vicinity of NIH. In addition to the NIH entrance at Center Drive, there are entrances at North, Wilson, and South Drives (Figure 5-8). One of the two NNMC entrances is at South Drive; the other is just south of North Drive. All NIH entrances are signalized except for North Drive which is stop sign controlled. Left turn lanes are present on Rockville Pike in the northbound direction at Center Drive, South Drive, Wilson Drive, and West Cedar Lane. The posted speed limit on Rockville Pike is 35 mph.

Old Georgetown Road is a six-lane divided roadway providing access to NIH from the Capital Beltway, I-270, and parts of Montgomery County to the north and west, and the Bethesda CBD to the south. Old Georgetown Road runs parallel to Rockville Pike in an arc to the west terminating at Rockville Pike about four miles to the north of NIH, and at Wisconsin Avenue in the Bethesda CBD. Within the vicinity of NIH, West Cedar Lane, the three NIH entrances at Center, South, and Lincoln Drives, and Huntington Parkway intersections are signalized. Southbound left turn lanes exist at all of the above intersections except Huntington Parkway. The posted speed limit is 40 mph.

Jones Bridge Road is a four lane roadway providing access between NIH and Chevy Chase to the east. Westbound Jones Bridge Road widens at the Rockville Pike intersection to accommodate a right turn lane and an exclusive left turn lane. The posted speed limit is 40 mph.

Cedar Lane is a four lane undivided road providing access between Kensington to the northeast of NIH and Rockville Pike. It continues along the northern boundary of NIH as West Cedar Lane to Old Georgetown Road. Although West Cedar Lane is wide enough for four lanes, it operates as a two lane facility with parking on both sides except for the approaches to Rockville Pike and Old Georgetown Road. NIH previously had four entrances along West Cedar Lane but only West Drive, which is signaled, remains. West Drive is currently closed to traffic. The posted speed limit on West Cedar Lane is 30 mph. Center Drive is the primary circulation road within the NIH campus and is an extension of Jones Bridge Road at Rockville Pike. The posted campus speed limit is 25 mph.

Until September 2001, NIH had 11 two-way or bidirectional vehicle access entrances around the periphery of the campus with the exception of South Drive at Old Georgetown Road. In response to directives for increased federal facility security, NIH has established a new permanent fenced perimeter

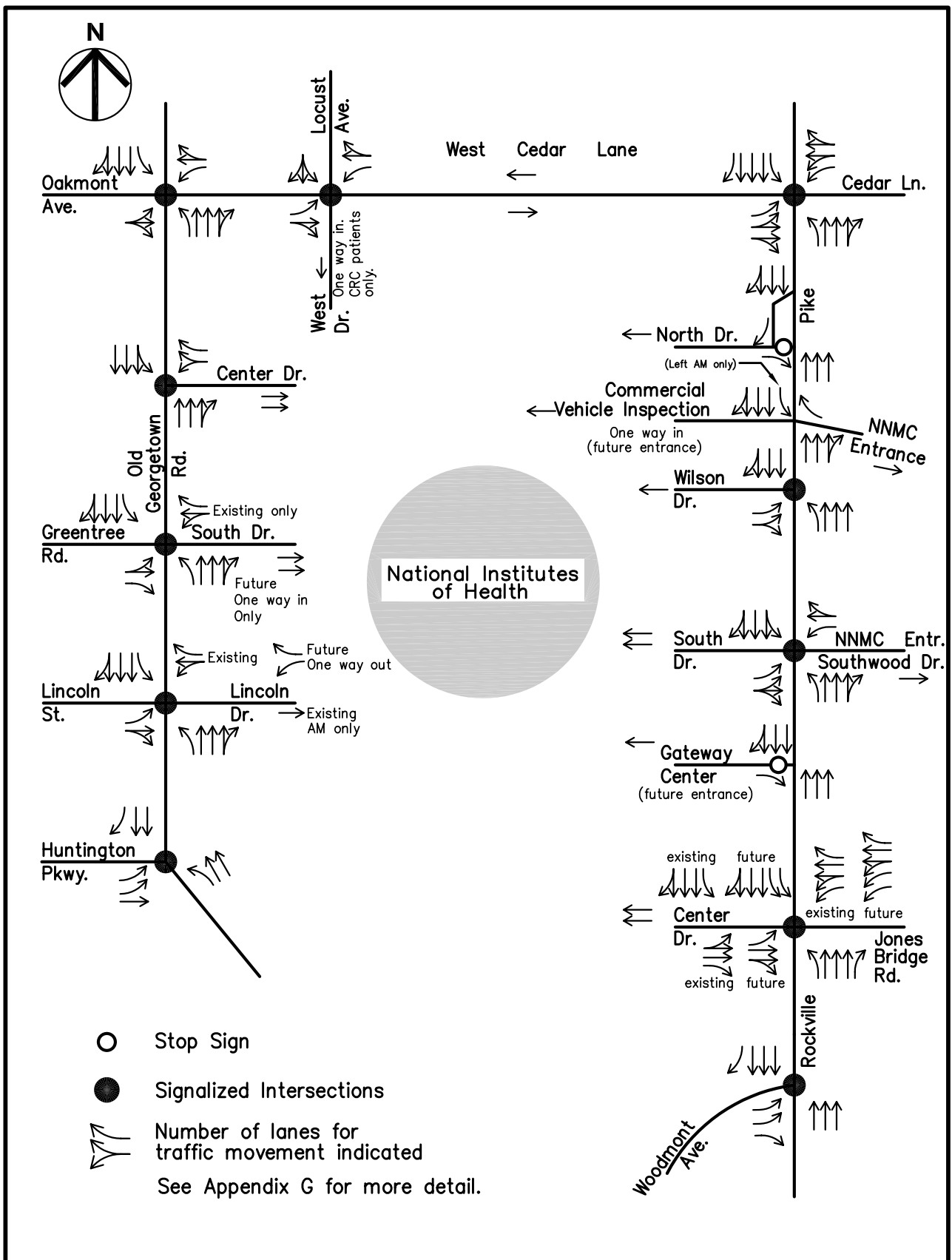


FIGURE 5-8 NIH ROAD ENTRANCES AND ADJACENT INTERSECTIONS.

and controlled access to the campus. A number of changes have been implemented, but access is in a transitional state.

On an interim basis, the number of vehicle entrances has been reduced to eight, but the West Drive entrance is closed to traffic under everyday operations. Employees can enter the campus at seven locations, three on Old Georgetown Road, and four on Rockville Pike. Commercial vehicle and general visitor traffic, which includes all non-NIH vehicles, are limited to entry at two points; South Drive on Rockville Pike, and Center Drive on Old Georgetown Road.

Change to the ultimate vehicle and pedestrian/bicycle access configuration will be the same under the Master Plan and No Action Alternatives. This will occur as soon as the Commercial Vehicle Inspection Facility and Gateway Visitor Center complex are in service. There will then be ten vehicle portals through the security perimeter, and additional gates, for exclusive biker and pedestrian use.

NIH employee traffic will be separated from other traffic entering the campus. This will permit a comparatively free flow of employee traffic with minimum queue lengths, while the non-NIH employee traffic that requires longer inspection times is routed to facilities designed for that purpose. The seven NIH employee portals are:

Old Georgetown Road

Lincoln Drive (one way out)

South Drive (one way in)

Center Drive

Rockville Pike

Center Drive

South Drive

Wilson Drive

North Drive

Although NIH employee entrances will be manned for security, nearly all NIH employee vehicles will be processed electronically. This could take the form of a Smart Card system similar to that now used on area toll roads, permitting a comparatively free flow of vehicles with minimal stoppages.

In the future, Lincoln and South Drives on Old Georgetown Road will operate as a one-way pair of roadways that, in effect, reduces the employee entry and exit points to six locations. Any of the portal roadways, however, could be used for employee egress into and out of the campus should circumstances dictate, e.g. an accident blocks a campus portal road. A slip ramp into an employee vehicle inspection queueing area is provided to the north of North Drive to minimize, when necessary, entering vehicle queues at other entrance locations. Vehicles would pass through the campus security perimeter on North Drive. North Drive would operate as a right turn out only exit. The Master Plan does not propose any employee entrances on West Cedar Lane.

Commercial vehicles, including all campus construction related traffic, will be routed to a new inspection facility along Rockville Pike. The facility entrance will be just to the south of North Drive, and will operate as right turn in only, i.e. no left turns from northbound Rockville Pike. Vehicles that pass inspection will enter the interior campus through the perimeter security fence via a new capacity bridge across the NIH Stream.

The remainder of inbound traffic is composed of general visitor vehicles. These visitors can be split into two components; inpatients and outpatients traveling to the Clinical Research Center for admissions and clinical trials, respectively, and all others. West Drive on West Cedar Lane will serve as an exclusive

entry point for the inpatients and outpatients. It will operate one way inbound. All other general visitors will enter the campus at a new entrance at the Gateway Center on Rockville Pike. It will operate as a right turn in - right turn out only entrance. These visitors may either park in the Visitor Center garage, which is outside the security perimeter, or continue on to the campus through a security check point and a connecting road between the Visitor Center area and Center Drive.

Vehicles of all types will be able to depart the campus at any portal that accommodates outbound traffic. All of the employee entrances except South Drive on Rockville Pike would be closed during the evening hours and on weekends.

5.3.2 Regional Transportation Planning

The Transportation Plan section of the Bethesda-Chevy Chase Master Plan assumes increasing use of transit services and a moderate level of road improvements to maintain the quality of life in the planning area (Bethesda-Chevy Chase Master Plan, M-NCPPC, 1990). The basic transportation strategy in the plan is to encourage the use of mass transit, carpooling, walking, and bicycling to reduce the demand for new roadway facilities. Use of such services is necessary, the plan notes, because it is difficult to expand the capacity of the area roads and these measures are needed to accommodate increased through traffic and the recommended level of development in Bethesda and Chevy Chase.

Improved transit and mobility services proposed in the Transportation Plan include:

- Increase the level of feeder bus services, particularly in the eastern half of the planning area.
- Provide park and ride lots for 750 vehicles at locations that would intercept vehicles destined to employment centers such as the Bethesda CBD, NIH, and the Naval Medical Center. Recommended potential locations were at I-495 and Kensington Parkway (250 spaces), and on River Road west of the Cabin John Fire Station No. 10 to the west of Seven Locks Road (500 spaces).
- Implement comprehensive ride share programs serving both employment and residential centers.
- Require new development to participate in traffic reduction programs.
- Expand the pedestrian and bike path system.

A moderate level of highway improvements as defined in the plan is:

- Completion of currently programmed projects.
- Endorsement of safety and sight distance improvements.
- Provide intersection capacity improvements at locations that currently operate with a Critical Lane Volume (CLV) of 1,650 or greater, or are likely to reach this CLV, over the next ten years. Improvements may include added turn lanes, lane widenings, and signal changes.
- Possibly endorse improvements to intersections to facilitate smoother traffic flow, even if they do not always achieve a fully acceptable Level of Service.
- Possibly require new development to participate in construction of improvements identified in the plan.
- Endorse reductions in through traffic on secondary and residential streets and, where possible, on primary streets and major highways.

The BCC Transportation Plan recognizes that Rockville Pike intersections at Pooks Hill Road, Cedar Lane, and Jones Bridge Road are operating at high peak hour levels of service. Traffic flow is characterized as very heavy between the Beltway and Jones Bridge Road, but not exceeding the capacity of Rockville Pike. The plan recommends that the six lane facility be retained from the Beltway to Woodmont Avenue. Widening of the road between the Beltway and Cedar lane is undesirable due to high potential property impacts. In the long term, after 2010, Rockville Pike could be widened to eight lanes

between Cedar Lane and Jones Bridge Road, if it were necessary to accommodate federal facility and Bethesda CBD growth, and the project included HOV lanes for peak traffic period use. This would be conditional on endorsement by the Montgomery County Council as an amendment or future revision to the Bethesda-Chevy Chase Master Plan. The plan also recommends that a possible grade separated interchange at Rockville Pike and Cedar Lane be retained as a possible project after the year 2010. The 2004 Constrained Long Range Transportation Plan (National Capital Region Transportation Planning Board, Metropolitan Washington Council of Governments (CLRP) (MWCOG), 2004), which has a planning horizon through 2030, does not include it.

Improvements are considered for the Pooks Hill Road and Cedar Lane intersections. Implementation of improvements would be dependent on the findings of studies by MD DOT and MC DOT, and further information on projected traffic growth as indicated in the Bethesda CBD Sector Plan and NIH Master Plan. At Cedar Lane, the following would be considered to reduce the critical lane volume:

- add a right turn lane to eastbound Cedar Lane
- add a through lane to westbound Cedar Lane
- add a right turn lane to northbound Rockville Pike

At the Jones Bridge Road intersection, the northbound Wisconsin Avenue right turn improvement recommended in the BCC Transportation Plan and included in the Capital Improvement Plan (CIP) has already been built. Further improvements currently planned include adding a left turn lane to westbound Jones Bridge Road and to southbound Rockville Pike.

The BCC Transportation Plan recommends retaining the existing width of Old Georgetown Road between the Beltway and Huntington Parkway. After 2010, a single HOV lane addition would be considered if it was necessary to reduce severe congestion and community impacts. The only recommended intersection improvement along this section of Old Georgetown Road is the addition of a short right turn lane on eastbound Greentree Road. The BCC Transportation Plan recommends no changes to Cedar Lane or Jones Bridge Road.

Many measures are proposed in transportation planning to reduce single occupant vehicle trips to and from the Bethesda CBD (Bethesda CBD Sector Plan, M-NCPPC, 1993). As in the BCC Master Plan, the Bethesda CBD Sector Plan recommends measures to increase transit use, car and vanpooling, walking, and biking. These include expansion of the Ride-On bus service and the CBD trail system, and consideration of incentives and disincentives to encourage non-automobile modes of travel.

To achieve the goal of gaining a significant shift from driving alone to alternate modes of travel, the Bethesda CBD Transportation Plan in the Sector Plan proposes the formation of a Transportation Management District (TMD) modelled on the Silver Spring TMD. In 2002, the number of CBD workers who did not drive to work is 27 percent. The objective is to increase this to 32 percent before actual Stage I development proposed in the CBD Sector Plan is complete.

For road system improvements, the CBD Transportation Plan used the mid- and long-term improvements identified in the 1990 Bethesda-Chevy Chase Master Plan as a starting point for its recommendations. The CBD Transportation Plan does not recommend any major widening of the existing road network. The Sector Plan identifies a future need to implement a peak period reversible lane on Old Georgetown Road from Woodmont Avenue northward to Huntington Parkway, and subsequently extend it from Huntington Parkway to north of West Cedar Lane when traffic conditions warrant it. The plan notes that installation of the lane would require the removal of the existing median but otherwise could be done within the current right-of-way. The Sector Plan would accelerate the schedule for construction of the reversible lane over that proposed in the BCC Transportation Plan.

The CBD Transportation Plan also recognizes a possible future need for converting Wisconsin (northbound) and Woodmont (southbound) Avenues into one way pairs through the CBD. While the concept resolves many traffic flow problems, there are concerns about retail accessibility and visibility, and pedestrian safety. At the Wisconsin Avenue/Woodmont Avenue intersection, congestion is projected as growth occurs in the Woodmont Triangle and traffic increases along Wisconsin Avenue/Rockville Pike. The CBD Sector Plan proposes turning lane improvements to increase intersection capacity.

At Rockville Pike and Cedar Lane, the CBD Transportation Plan noted the improvements proposed in the BCC Master Plan. The CBD Sector Plan, however, sees the need for additional north and south through lanes on Rockville Pike at the intersection rather than additional turning lanes proposed in the BCC Plan. The Sector Plan notes that the actual improvements needed are dependent on a good projection of NIH generated traffic as well as that travelling to and from the CBD. The CBD plan also recommends maintaining the possibility of a future grade separation at this location. The grade separation could allow direct access to the NIH campus, reducing congestion at many other entrances to NIH along Rockville Pike.

On a regional scale in the Washington metropolitan area, transportation planning is taking a significant change of course as a result of recent federal legislation. These changes may have a significant effect on how individuals commute to work and travel through the area.

The regional Constrained Long Range Transportation Plan outlines improvements, actions, strategies, and studies needed by the region to comply with Clean Air Act Amendments of 1990 (CAAA) (42 U.S. C. § 7407(d)) and the Transportation Efficiency Act for the 21st Century (TEA-21) regulations. The plan conforms to the CAAA requirements in that ground level ozone, volatile organic compounds, and nitrogen oxide regional emissions will be lower than they would be if the plan were not implemented. The plan has a 25 year planning horizon. It is constrained in that it may include only those transportation projects for which revenues can be "reasonably expected to be available" as required by TEA-21 and by U.S. EPA classification of the Washington Metropolitan area as being in "severe" non-conformity for ground level ozone. It is subject to change in that the TEA-21 will undergo reauthorization in 2004. The plan is based on growth projected in the MWCOC Round 6.3 forecasts for regional population and employment. Regionally, the population is expected to increase from 4.55 million in 2000 to 5.82 million in 2020, and the number of jobs by 46 percent. The Montgomery County population is projected to increase from 873,000 in 2000 to 1.05 million in 2020. County vehicle registrations are forecast to increase from 671,000 to 995,000 in the same period.

There are three projects in the Constrained Long Range Plan that could influence NIH transportation conditions in the long term. The first is the Bi-County transitway that would connect Silver Spring and Bethesda with a light rail line following an abandoned railroad right of way for most of its length. Montgomery County has purchased the right-of-way, and the Bethesda CBD Plan suggests two alternatives for connecting the line to the Metrorail station in Bethesda. The Constrained Long Range Plan calls for implementation by 2012, but funding only for studies is programmed.

The other two projects are major long term Constrained Long Range Plan projects involving multimodal improvements in the I-270/US15 and the I-495 Capital Beltway transportation corridors. In the former project, US15 and I-270 would be widened between MD Route 26 north of Frederick, Maryland, and Shady Grove Road near Gaithersburg. US15 would be widened to six lanes. The number of lanes on I-270 would increase progressively as one proceeds southward to ultimately match the existing 12-lane I-270 at Shady Grove Road. HOV and Transportation Demand Management measures such as park and ride lots and bus transit will be included throughout.

Rail transit will not be present within the highway corridor but has been provided by an extension of

MARC service from Point of Rocks, Maryland to Frederick using existing railroad lines. The Frederick service was initiated in 2002. Draft Environmental studies for the I-270/US15 corridor were completed in 2002.

The Capital Beltway Study is evaluating multimodal transportation alternatives for a wide circumferential corridor centered on I-495 through Montgomery and Prince George's Counties. Studies to date have determined that Beltway road widening will be limited to expansion to 10-lanes with two of the lanes devoted to HOV and express bus service.

5.3.3 Memorandum of Understanding

In May 1992, NIH executed a Memorandum of Understanding (MOU) with the NCPC and the Montgomery County Planning Board (MCPB) (see Appendix C). In the MOU, NIH committed itself to a best faith effort to implement Transportation Management Plan (TMP) strategies in order to achieve the following TMP goals:

- Improvement in the availability of parking spaces on campus for NIH personnel and visitors.
- Mitigation of traffic impacts created by further campus development on the roadways serving the campus such that the level of congestion along the roadways is made no worse than if such development did not occur.
- Maintain a "good neighbor" relationship with the surrounding community.

NIH also committed itself to a best faith effort to implement TMP short-and long-term strategies to achieve these goals. Strategies included measures for reducing or mitigating traffic generated by NIH, and control of campus parking.

Strategies in the TMP are:

- Establishment of an Employee Transportation Services Office to coordinate the TMP and promote non-single occupant travel modes by employees.
- Continuation of and emphasis on carpool and vanpool programs and placement of carpool, vanpool, handicapped and visitor parking in close proximity to user destinations.
- Implementation of transit discount programs for employees to the maximum tax free benefit allowable by law.
- Improvement of NIH shuttle bus service as demand warrants.
- Further promotion and publicizing of existing TMP measures.
- Implementation of an internal loop road circulation system within the NIH campus with two way traffic.
- Improvement of congested roadway intersections around NIH's perimeter through the addition of more turning lanes to selected intersections adjacent to the NIH campus to mitigate traffic congestion.
- Explore the feasibility of developing or leasing satellite parking areas near outlying Metrorail Red Line stations to serve NIH employees.

The three agencies agreed to meet periodically to discuss planning and transportation issues. NIH would monitor the results of the TMP by providing NCPC and MCPB with semiannual traffic counts and evaluations of the program.

One goal of the MOU is that the level of traffic congestion created by any development proposed by NIH on roadways and intersections near the campus should be no worse than if such NIH development did not occur. Congestion would increase from growth in traffic from sources outside NIH, regardless of NIH

activities. However, if the congestion increased as a result of NIH activities, then mitigation measures would be taken by NIH.

A traffic frame of reference or measure of performance is needed to assess the effects of NIH generated traffic within the changing environment of overall traffic changes. If the MOU goal is to be met, then it is implied that development proposed in the Master Plan cannot generate more peak hour trips than were generated by NIH at the time of the MOU baseline surveys in 1992, when NIH generated 5,888 AM peak hour trips (4,925 inbound and 963 outbound) and 5,772 PM peak hour trips (1,322 inbound and 4,450 outbound).

Further, the contribution of NIH to congestion on road links and intersections surrounding the campus should be no worse than that associated with the 1992 MOU reference NIH generated traffic. Since the background level of traffic is continuously increasing, the MOU reference level of congestion increases with time, even though NIH may hold its trip generation at or less than 1992 MOU reference levels (Figure 5-9). Projected MOU reference traffic levels are equivalent to a 1992 No Action Alternative for assessing traffic impacts, i.e. conditions that would exist if NIH undertook no activities after the 1992 MOU baseline traffic survey was conducted.

The 1992 MOU reference traffic surveys counted traffic through the NIH entrances and on the campus perimeter roads, but did not include intersection congestion analysis. The May 1993 NIH traffic survey was the first to do so. The data from this survey are therefore given as a reference of conditions on the road network and intersections. However, the NIH peak period traffic contribution had already declined by ten percent by May 1993 due to initial TMP measures (Table 5-7). The 1993 reference traffic and congestion is therefore lower than what was present at the time of the execution of the MOU.

The baseline total MOU traffic volume advances or changes with time. It is equal to the 1992 MOU NIH contribution to traffic in the terms of trips through the campus entrances, plus the background or non-NIH traffic present when assessment of conformance or impacts is conducted. The 2003 total MOU traffic volumes are higher than those in 1992 or 1993 because of significant growth in background traffic.

The 1992 and 1993 reference surveys were based on the pre-September 2001 campus entrance configuration. Changes in the entrance configuration and use require adjustment to the NIH 1992 MOU reference contribution to the 2003 total MOU reference volume. This has been done by redistributing the 1992 NIH entrance traffic to the 2003 and proposed 2020+ Master Plan entrance configurations.

5.3.4 Existing NIH Transportation Management Program

In October 1991, the NIH created an Employee Transportation Services Office (ETSO), and staffed a position with the responsibility of carrying out its Transportation Management Plan efforts in a more coordinated manner. In general, it is the responsibility of the ETSO to work with other administrative staff to monitor the effectiveness of existing transportation management programs and adjust them to make them more effective. Also, the ETSO continues to research new programs, and test and implement them if they prove to be effective.

The NIH ETSO has effectively expanded and enhanced the NIH TMP since its inception. Most of the short term TMP strategies proposed in the original 1992 program have been implemented. Although the campus employee population has increased by seven percent between 1992 and 2003 (from 16,350 to 17,500), the total number of AM and PM peak hour trips into and out of the campus has decreased by 29 and 46 percent, respectively, from the reference MOU trips.

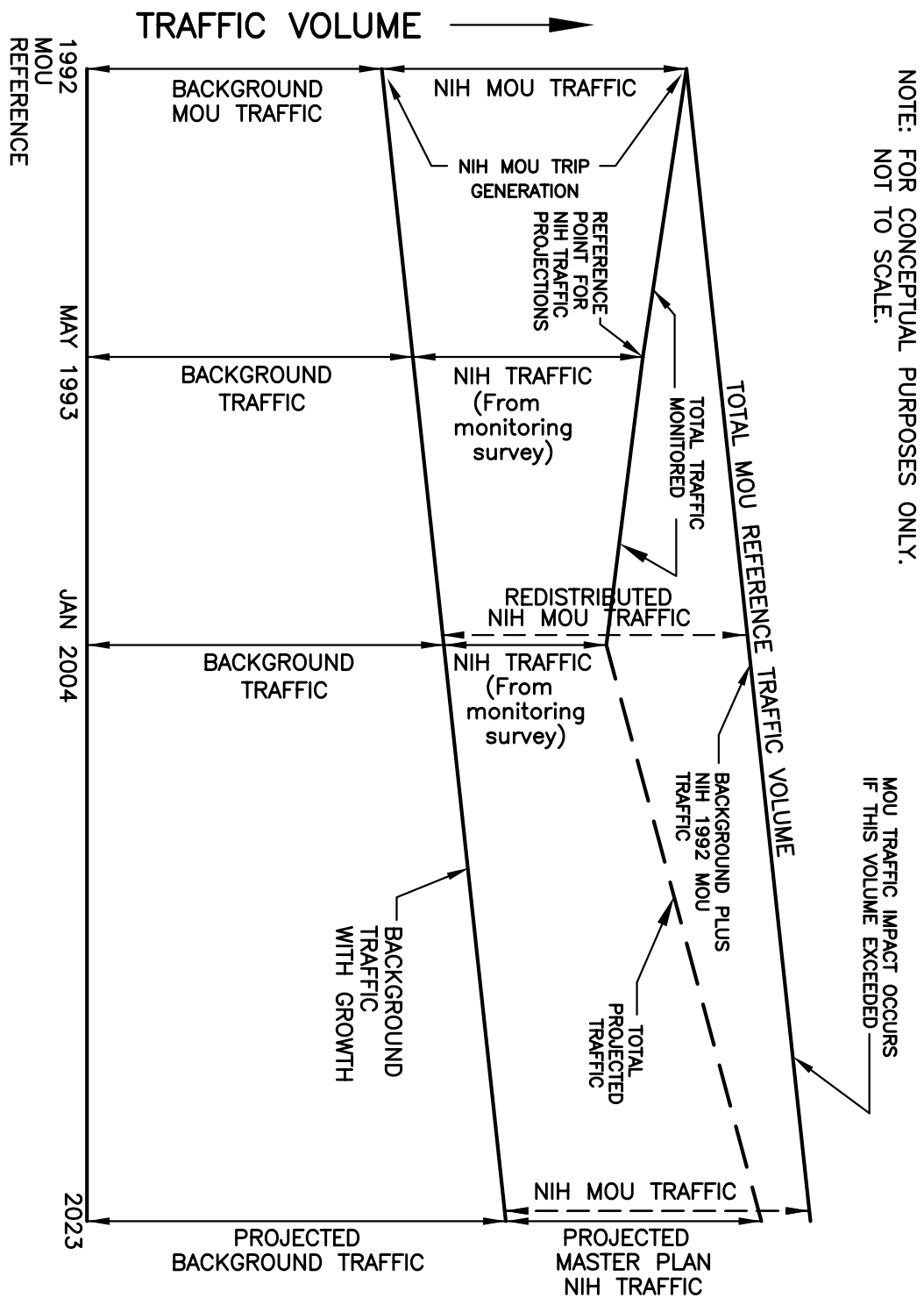


FIGURE 5-9 TRAFFIC IMPACT CONCEPTS.

AM PEAK HOUR NIH TRIPS					PM PEAK HOUR NIH TRIPS			
<u>SURVEY</u>	<u>IN</u>	<u>OUT</u>	<u>TOTAL</u>	<u>%⁽²⁾</u>	<u>IN</u>	<u>OUT</u>	<u>TOTAL</u>	<u>%⁽²⁾</u>
1992 MOU	4,925	963	5,888	--	1,322	4,450	5,772	--
MAY 1993	4,384	858	5,242	10.9	1,177	3,961	5,138	11.0

AM PEAK PERIOD 6:30-9:30 AM NIH TRIPS IN			<u>%⁽²⁾</u>	PM PEAK PERIOD 3:30-6:30 PM NIH TRIPS OUT		<u>%⁽²⁾</u>
<u>SURVEY</u>						
1992		10,978	--		10,815	--
MAY 1993		9,857	10.2		9,711	10.2

(1)	Percentage reduction from May 1992 or MOU reference trips.							
-----	--	--	--	--	--	--	--	--

TABLE 5-7 COMPARISON OF NIH TRIP GENERATION BETWEEN 1992 AND 1993.

Current TMP measures include the following:

- **TMP Coordination** - The NIH ETSO maintains membership in other affiliated TMP groups participates in their activities, and shares information. The ETSO works cooperatively with the NIH/Naval Medical Center/Suburban Hospital/Montgomery County Transportation Management
- **Organization**, North Bethesda Transportation Management District (TMD) organizations, and Keep Montgomery County Moving.
- **TMP Information** - The ETSO Transportation Information Office provides NIH employees and visitors with website information on public transit routes and schedules, NIH shuttle routes and schedules, and visitor parking.
- **TMP Promotion and Education** - The ETSO actively stresses the importance of using transportation alternatives other than single occupancy vehicles to NIH employees. New employees are informed about NIH transportation conditions and commuting options through monthly orientation meetings. The ETSO also holds Commuter Transportation Fairs where many vendors associated with alternative commuting modes of travel (vanpool, carpool, transit, bicycling, express buses) can explain and provide information on their programs.
- **NIH TRANSHARE Program** - Currently, there are 3,971 employees participating in this program. NIH employees now receive up to \$100.00 per month in transit subsidy funds.
- **Carpool Program** - There are currently 380 registered carpools accounting for over 760 NIH employees on the NIH campus. Carpool parking spaces are maintained in close-in parking lots and are reserved until 9:30 a.m. For individuals participating in vanpools, reserved parking spaces are set-aside in their lot of choice. Vanpoolers are eligible to participate in the NIH TRANSHARE Program to subsidize their commuting costs.
- **Ridematching Program** - employees are provided with a list of other people who are also looking to participate in the program, usually within two business days of their request. The NIH ETSO is very active in promoting and facilitating this program through the maintenance of an accurate database of

all participants.

- **Guaranteed Ride Home Program** - NIH participates in this program, which is sponsored by the Metropolitan Washington Council of Governments. The program guarantees commuters, who regularly carpool, vanpool, bike, walk or take transit to work, a reliable ride home when they need to work overtime, or another unexpected reason to leave work arises. The ride, using a taxi or other transit, is free to the user.
- **Alternative Work Schedule Program** - NIH offers an alternative work schedule program, which allows some NIH employees the opportunity to work a four day schedule each week.
- **Telecommuter Work Program** - Some NIH employees are given the opportunity to work from home one day a week, maintaining contact with their office via fax machine, e-mail, and telephone.
- **Campus Radio Station** - A new radio station disseminates real time information about traffic conditions on, and in the vicinity of, the Bethesda campus.
- **NIH Shuttle System** - NIH has its own comprehensive shuttle system, which provides regular service to the whole campus and to most of its off-campus work locations.
- **NIH Express Bus Routes** - NIH has implemented several express bus routes which link the Bethesda campus directly to the Milestone Park & Ride Lot in Germantown, MD, the Lake Forest Park & Ride Lot in Gaithersburg, MD, and the New Carrollton Metro Station in Prince George's County, MD. These express buses operate during the morning and evening rush periods.
- **Off-Campus Satellite Parking** - There are currently 575 spaces available to NIH employees at off-campus, satellite locations. Employees can park for free at these locations and then either ride Metrorail or a free shuttle bus to the campus, depending upon the location.
- **Managed Parking Facilities** - For those employees who must drive to work, a parking management company has been utilized to assist in parking employees and visitors to the NIH campus. This allows for increased efficiency in the utilization of several parking facilities on campus. The managed parking also discourages illegal or lengthy parking and enhances the security of the parking areas.
- **Paid Visitor Parking** - NIH has implemented paid visitor parking on the Bethesda campus to discourage employees from parking in visitor parking spaces.
- **Construction Contractor Employee Parking** - Construction is underway at NIH on a nearly continuous basis. All construction contractor employees must either park on the campus in available visitor spaces or at off-campus lots. NIH maintains a satellite lot at Pooks Hill for the exclusive use of contractors.
- **TMP Monitoring** - The NIH ETSO monitors the effectiveness of existing TMP measures and activities on a continuing basis. Monitoring includes semiannual traffic counts at the NIH entrances to confirm continuing conformance to the MOU. ETSO also periodically surveys or maintains records on the usage of alternative travel modes such as public transit and the NIH shuttle.

5.3.5 Existing And Projected NIH Trip Generation

Additional information on existing and projected traffic and parking conditions at the NIH Bethesda campus are provided in Master Plan Transportation Report for the NIH Main Campus. Details are given for existing traffic surveys, NIH and background vehicle trip generation, intersection turning movements and Critical Lane Volume (CLV) methodology, and other analytical support materials. Analytical procedures for traffic projections follow the County Local Area Transportation Review (LATR) methodology.

Traffic is monitored semiannually at NIH to determine conformance with MOU conditions, assess the effectiveness of NIH TMP measures, and provide base information on traffic patterns at NIH entrances and within campus. Counts of traffic are made in the Spring (generally April or May) and Fall (generally September or October) as recommended in the Traffic Volume Control Station Report, Montgomery County Division of Traffic Engineering, 1990. Traffic volumes counted on a typical weekday during these periods are close to, or representative of, the average traffic volume for the year during the AM and PM peak hours.

The semiannual traffic survey monitors traffic at each NIH entrance and selected intersections around the campus periphery. Traffic is monitored continuously for up to seven days using 24-hour automatic machine counters at each entrance in operation. In addition, AM peak period (6:30 AM to 9:30 AM) and PM peak period (3:30 PM to 6:30 PM) traffic counts may be made visually at all NIH perimeter intersections when circumstances dictate. The visual survey monitors or counts all vehicle movements, i.e. through and left and right turns.

NIH trip generation is defined as the number of vehicles that pass through the campus entrances in both directions. All vehicles are counted regardless of whether they are driven by NIH employees or not. Data for trip generation is based on the automatic machine counts recorded in the semiannual traffic surveys. The AM and PM peak hour NIH trip generation is of primary interest as a measure for conformance to the 1992 MOU.

Data for past, present, and future NIH trip generation for the AM and PM peak hours are shown in Tables 5-8 and 5-9 respectively. Data shown in the Tables for 1992 MOU reflect conditions prior to implementation of NIH TMP measures and signing of the MOU. In January and March 1992, traffic volumes were counted at ten NIH entrances for the peak traffic hour (William N. Natcher Building, Site Access and Area Highway System Analysis, Barton-Aschman, Assoc. 1992). Additional survey counts were made in August to establish the baseline traffic conditions for implementation of the MOU (Traffic Monitoring Program Base Condition Surveys, Barton-Aschman, Assoc., 1992). Since the baseline survey was conducted in August, when many employees are on vacation, the data in for 1992 MOU conditions probably underestimated the baseline traffic flows.

Prior to September 2001, NIH had 11 entrances with bi-directional traffic. The 2003 MOU column in the tables reassigns the 1992 MOU trips to the post September 2001 entrance configuration. Further changes in the entrance configuration will occur with the construction of the Commercial Vehicle Inspection facility and Gateway Visitor Center. The 2020+ MOU data redistributes arriving commercial and visitor traffic to the ultimate Master Plan entrance configuration. The 2003 and 2020+ MOU reference trip generation is subsequently used in the intersection congestion traffic analysis (see Section 5.3.7).

Data from the November 2000 survey are given as a reference to show monitored conditions prior to September 2001. Until then, NIH still had eleven entrances with free access. Most of the decline in NIH entrance trips between 1992 and 2000 occurred along Old Georgetown Road. A lesser drop was

ENTRANCE		AM PEAK HOUR (7:30 - 8:30 AM)					
		1992 MOU	NOV 2000	OCT 2003	2003 MOU	2020+ MP	2020+ MOU
Rockville Pike entrances							
Center Drive	IN	1,068	604	852	1,026	785	833
	OUT	166	97	58	115	102	166
Gateway Center	IN	---	---	---	---	369	391
	OUT	---	---	---	---	45	72
South Drive	IN	324	255	335	710	530	550
	OUT	59	205	140	423	113	164
Wilson Drive	IN	450	471	564	987	701	745
	OUT	141	149	46	218	114	184
Commercial Vehicle	IN	--	--	--	--	91	97
	OUT	--	--	--	--	--	--
North Drive	IN	426	400	269	49	412	438
	OUT	42	29	5	9	5	9
Subtotal Rockville Pike		2,676	2,210	2,269	3,537	3,267	3,649
West Cedar Lane entrances							
East Drive	IN	180	261	63	--	--	--
	OUT	37	23	49	--	--	--
Garden Drive	IN	79	65	--	--	--	--
	OUT	32	13	--	--	--	--
Zelkova Drive	IN	56	34	--	--	--	--
	OUT	17	7	--	--	--	--
West Drive	IN	548	464	0	0	28	31
	OUT	86	146	0	0	0	0
Subtotal West Cedar Lane		1,035	1,013	112	0	28	31
Old Georgetown Road entrances							
Center Drive	IN	611	347	221	538	914	964
	OUT	81	139	0	0	125	202
South Drive	IN	204	136	898	685	827	876
	OUT	138	62	60	132	0	0
Lincoln Drive	IN	979	565	584	930	0	0
	OUT	164	100	46	66	103	166
Subtotal Old Georgetown Road		2,177	1,349	1,809	2,351	1,969	2,208
Total in		4,925	3,602	3,786	4,925	4,657	4,925
Total out		963	970	404	963	607	963
Total Peak Hour		5,888	4,572	4,190	5,888	5,264	5,888

TABLE 5-8 NIH AM PEAK HOUR TRIP GENERATION.

ENTRANCE		PM PEAK HOUR (4:45 - 5:45 PM)					
		1992 MOU	NOV 2000	OCT 2003	2003 MOU	2020+ MP	2020+ MOU
Rockville Pike entrances							
Center Drive	IN	246	154	75	114	71	187
	OUT	738	570	639	1,375	971	1,262
Gateway Center	IN	--	--	--	--	102	247
	OUT	--	--	--	--	59	78
South Drive	IN	183	176	190	648	99	168
	OUT	240	203	397	460	420	539
Wilson Drive	IN	138	90	41	140	63	168
	OUT	963	427	511	798	535	697
Commercial Vehicle	IN	--	--	--	--	8	20
	OUT	--	--	--	--	--	--
North Drive	IN	63	89	0	0	37	99
	OUT	168	104	126	133	33	44
Subtotal Rockville Pike		2,739	1,813	1,979	3,668	2,398	3,509
West Cedar Lane entrances							
East Drive	IN	18	94	2	--	--	--
	OUT	124	100	2	--	--	--
Garden Drive	IN	27	29	--	--	--	--
	OUT	123	103	--	--	--	--
Zelkova Drive	IN	16	34	--	--	--	--
	OUT	90	70	--	--	--	--
West Drive	IN	89	78	0	0	8	20
	OUT	314	326	0	0	0	0
Subtotal West Cedar Lane		801	834	4	0	8	20
Old Georgetown Road entrances							
Center Drive	IN	316	158	43	280	82	216
	OUT	653	356	0	443	770	1,002
South Drive	IN	100	50	79	140	75	197
	OUT	364	24	420	266	0	0
Lincoln Drive	IN	126	177	38	0	0	0
	OUT	673	512	596	975	636	828
Subtotal Old Georgetown Road		2,232	1,277	1,176	2,104	1,563	2,243
Total in		1,322	1,129	468	1,322	545	1,322
Total out		<u>4,450</u>	<u>2,795</u>	<u>2,691</u>	<u>4,450</u>	<u>3,424</u>	<u>4,450</u>
Total Peak Hour		5,772	3,924	3,159	5,772	3,969	5,772

TABLE 5-9 NIH PM PEAK HOUR TRIP GENERATION

experienced along Rockville Pike while trips through the portals along West Cedar Lane remained relatively constant. Overall, the number of AM peak hour trips declined from 5,888 in 1992 to 4,572 in 2000, or 22 percent. Similarly, the overall PM peak hour entrance trips dropped from 5,772 to 3,924, or 32 percent. The principal TMP measure leading to the reductions has been the TRANSHARE program, which provides subsidies to employee participants to partially offset fare costs.

The October 2003 survey data represent a new existing baseline under the new access conditions. As expected, the 2003 survey shows a significant transfer of portal trips from closed entrances on West Cedar Lane to Rockville Pike and Old Georgetown Road. Overall, peak hour trips continued to decline between November 2000 and October 2003, particularly in the minority or reverse peak direction movements, outbound in the morning, inbound in the afternoon. The total 2003 AM and PM peak hour volumes fell to 4,190 and 3,159, respectively. About half of the minority direction peak hour trips in 2003 were identified as non-employee trips, i.e. visitors, buses, trucks, and NIH shuttle. Since 1992, NIH trip generation rates have declined at a greater rate than the absolute trip counts because of an increase in campus population as noted below:

	<u>TRIPS</u>	<u>EMPLOYEES</u>	<u>TRIP/EMPLOYEE</u>
AM PEAK HOUR			
1992 MOU	5,888	16,325	0.36
Nov 2000	4,572	17,600	0.26
Oct 2003	4,190	17,511	0.24
PM PEAK HOUR			
1992 MOU	5,772	16,325	0.35
Nov 2000	3,924	17,600	0.22
Oct 2003	3,159	17,511	0.18

Past studies have revealed that the times for peak NIH trip generation are not concurrent with those for the NNMC, and Bethesda CBD or general background traffic, and this was true in October 2003. The 2003 AM and PM peak hours for NIH traffic were 7:30 - 8:30 AM and 4:45 - 5:45 PM, respectively. The corresponding peak hours for overall system or background traffic were 8:00 - 9:00 AM and 5:00 - 6:00 PM, respectively.

The values in Tables 5-8 and 5-9 show peak NIH trip generation, and are greater than those experienced during the peak system hours. For example, the AM and PM peak hour NIH trip generation for the hours starting at 8:00 AM and 5:00 PM are 3,175 and 2,984, respectively. The latter are used in traffic and intersection analysis shown in subsequent sections to meet M-NCPPC Local Area Transportation Review criteria and guidelines for traffic analysis.

The NIH AM peak hour trip generation is higher than the PM peak hour because arrivals are more concentrated over time than departures. A great majority of employees start work at either 8:00 AM or 8:30 AM. Separate studies indicate that visitor arrivals are high at this time. Departures are dispersed over a greater interval with counts between 1,500 and 2,000 as late as 6:30 PM to 7:30 PM.

Projected Master Plan NIH generated trips were estimated by applying October 2003 trip generation per employee rates to a projected campus population of 22,000. This assumes that the TMP would continue at the same rate of effectiveness. Adjustments were made to reflect changes in access. The West Drive entrance would be converted to a one-way inbound entry point for the exclusive use of clinical center patients and their visitors. On Old Georgetown Road, South and Lincoln Drives would operate as one-way pairs. On Rockville Pike, two new entrances, one for a commercial vehicle inspection facility and

one for the visitor center, would be added to the existing portals. Departures for this traffic would be via any of the other available entrances.

Under Master Plan conditions with a campus employee population of 22,000, the total AM and PM peak hour portal trips are projected to be 5,266 and 3,975, respectively. Both volumes are less than the 1992 MOU trip counts. Under the No Action Alternative, the total number of NIH AM and PM peak hour vehicle trips would increase to an estimated 4,274 and 3,222, respectively.

NIH would therefore meet the MOU criteria for holding peak hour trip generation below 1992 levels. It should be noted that NIH can meet the MOU peak hour trip generation criteria with 22,000 employees as long as the AM peak hour trip generation rate is 0.268 ($5,888/22,000$) or less, and the PM peak hour rate is 0.262 ($5,772/22,000$).

The direction from which NIH generated traffic approaches the campus during the AM peak period is shown in (Table 5-10). Slightly more than half the vehicles approach the campus from the north via Rockville Pike and Old Georgetown Road. It is inferred from information about employee home zip codes that a large percentage of these drivers are using I-270 or the Beltway to reach the campus from upper Montgomery County and counties to the north as well as Prince George's County and Virginia. Analysis of the data indicates NIH employees choose the most efficient route to their ultimate campus destination. Route decisions are made some distance from the campus and the access route in the vicinity of the campus is the most direct to a desired parking area. Few employees traverse two sides of the campus on their approach route.

Comparison of data for 1992 and 2003 shows no substantive difference in the direction employees approach the campus. Since the absolute number of trips decreased between 1992 and 2003, all of the percentage values for the latter year represent decreases in approach volumes, except for Cedar Lane. The Cedar Lane increase is probably attributable to those employees who are traveling westbound on the Beltway to the campus from points to the east. They are leaving the Beltway at Connecticut Avenue, one exit early, instead of the Rockville Pike interchange to avoid congestion at the latter. The percentage as well as absolute declines in the number of drivers approaching from the south on Rockville Pike and Old Georgetown Road are most likely due to a high proportion of them switching to transit, particularly the Red Line.

Campus census data for 2000 indicated that 630 NIH employees live in zip code area 20817. The zip code area generally covers an area west of the campus that is inside the Beltway, although it extends to Bradley Boulevard beyond the Beltway on the west side. These employees account for nearly all the NIH generated traffic traveling to and from the west of the campus via Lincoln Street, Greentree Road, and Oakmont Avenue. The estimated NIH generated peak hour traffic on these three streets combined is about 140 to 155 vehicles. The total combined AM and PM peak hour traffic volumes on these streets in the October 2003 traffic survey were 1,236 and 1,090, respectively.

5.3.5.1 Commercial Vehicle Traffic

Commercial vehicle arrivals were counted at the visitor vehicle inspections over a three day period between 7:00 AM and 7:00 PM in July 2003. A total of 1,418 vehicles, or an average of 473 per day, were inspected. They represented 65 different service companies or organizations that arrived during the monitoring period (Table 5-11). The peak recorded hourly volume during the three day survey was 83, which occurred between 9:15 AM and 10:15 AM. Commercial vehicles arrive as early as 5:00 AM. Arrival volumes were evenly split between the Old Georgetown Road and Rockville Pike visitor entrances.

Location and Approach Direction	Percentage of Drivers Using Approach Direction	
	1992	2003
Rockville Pike - southbound at Cedar Lane	27	28
Old Georgetown Road - southbound at Cedar Lane	24	23
Old Georgetown Road - northbound at Lincoln Drive	13	7
Jones Bridge Road - westbound at Rockville Pike	12	12
Cedar Lane - westbound at Rockville Pike	10	18
Rockville Pike - northbound at Jones Bridge Road	10	7
Lincoln Drive - eastbound at Old Georgetown Road	2	0.2
Greentree Road - eastbound at Old Georgetown Road	1	4
Oakmont Avenue - eastbound at Old Georgetown Road	1	0.8
Total	100	100

TABLE 5-10 NIH EMPLOYEE VEHICLE ROUTES TO BETHESDA CAMPUS.

Commercial vehicle traffic includes that related to construction. Construction traffic can vary from no or a few vehicles on a given day to short term heavy volumes. Examples of periodic high volume construction traffic include transport of earth excavation or fill material, and delivery of concrete, masonry and steel during building construction. Construction traffic accounted for 180 of the commercial vehicle arrivals, or nearly 13 percent. Of these, 66 were trucks carrying asphalt for a maintenance paving project.

Cars, SUVs, as well as small vans, panel trucks, and pickup trucks comprise 45 percent of the commercial traffic. The remainder are larger, two to four axle vans and trucks, but four axle trucks, semis and flat beds, account for less than three percent of the total traffic. The Building 10 Clinical Research Center complex was the destination for more than one third of the general commercial traffic. Nearly 10 percent were making multiple stops or providing services throughout the campus.

Most of the commercial traffic makes a single daily, weekly, or monthly trip to the campus. The 1,209 vehicles counted during the three day survey represented 650 different business organizations. Only a small proportion of the general commercial traffic makes multiple visits to the campus on a daily or frequently repeated basis. Five services account for about 18 percent of the average daily general commercial volume of 473 vehicles, as follows:

- Express and courier service 49
- Cafeteria/catering supply 11
- Computer/communications maintenance/service 9
- Trash and recycled material collection 8
- Government moving vans 7

It is estimated that most of the cafeteria food supply arrives prior to 7:00 AM.

HOUR BEGINNING	COMMERCIAL VEHICLES	HOUR BEGINNING	COMMERCIAL VEHICLES
7:00 AM	48	1:00 PM	51
8:00 AM	54	2:00 PM	36
9:00 AM	73	3:00 PM	26
10:00 AM	59	4:00 PM	11
11:00 AM	54	5:00 PM	6
Noon	51	6:00 PM	3

TABLE 5-11 AVERAGE HOURLY COMMERCIAL VEHICLE ARRIVALS IN 2003.

5.3.5.2 Visitor Vehicle Traffic

A three day count of general visitor traffic undergoing arrival inspections was made in July 2003. An average of 2,357 such visitors arrived per day between 7:00 AM and 7:00 PM (Table 5-12). The peak arrival hour occurred between 8:00 AM and 9:00 AM when the average number of arriving vehicles was 305. Hourly arrival volumes in the morning hours are relatively constant with the exception of the peak hour. Volumes decline steadily in the afternoon as the day progresses. The visitor vehicle mix is composed of light duty vehicles (cars, SUVs, passenger vans, and pickup trucks) exclusively. About 60 percent entered the campus at South Drive on Rockville Pike with the remainder entering at Center Drive from Old Georgetown Road. Visitors may depart by any available exit.

The counted visitor traffic does not include NIH employee visitors who work at off campus locations and visit the campus on business. The general visitor mix has many components. Three types of visitors are travelling to the Clinical Research Center. In 2002, there were 74,364 outpatient visits for one day clinical tests. If it is assumed that all arrive by vehicle, then this is an average of 295 per work day. There were also 7,494 inpatient hospital admissions, or an average of nearly 30 per work day. Based on an average stay of 7.6 days there were 225 inpatients in the hospital at any one time. The third type of CRC-related traffic is family and friends visiting inpatients.

5.3.5.3 Average Passenger Occupancy and Modal Split

Average Passenger Occupancy (APO) and Modal Split are transportation analysis parameters. APO is the average number of occupants per vehicle. Various modal means of transportation such as car, bus, rail transit, bicycle, and walking are available. A modal split is the proportion of a population that uses each transportation mode. The existing NIH Bethesda APO and modal splits were derived or estimated for the AM site entrance traffic peak hour because the best data were available for this period from various field surveys and data records.

HOUR BEGINNING	VISITOR VEHICLES	HOUR BEGINNING	VISITOR VEHICLES
7:00 AM	263	1:00 PM	199
8:00 AM	305	2:00 PM	165
9:00 AM	263	3:00 PM	128
10:00 AM	261	4:00 PM	112
11:00 AM	268	5:00 PM	104
Noon	213	6:00 PM	76

TABLE 5-12. AVERAGE HOURLY VISITOR ARRIVALS IN 2003.

The campus traffic survey completed in October 2003 counted the number of vehicles entering or inbound to the campus for various periods as shown below:

<u>Time</u>	<u>Vehicles</u>
AM Peak Hour (7:45 AM - 8:45 AM)	3,786
AM Peak Period (6:30 AM - 9:30 AM)	10,052
Daily (6:30 AM - 7:30 PM)	17,050

The number of vehicles arriving before 6:30 AM or after 7:30 PM is relatively small. The counts include all vehicles: employee vehicles, commercial vehicles, NIH shuttles, and visitors. AM peak hour traffic comprises about 38 percent of the AM peak period traffic, and about 22 percent of the daily inbound traffic. The computed APO for vehicles entering the campus through entrance checkpoints is 1.09 based on the following:

<u>Mode</u>	<u>Number of Vehicles</u>	<u>Average Occupancy</u>	<u>Occupants</u>
Single Occupant Vehicle (SOV)	3,690	1	3,690
High Occupancy Vehicle (HOV)	75	2	152
Vanpool	5	10	50
NIH Shuttle	<u>15</u>	16.1	<u>242</u>
	3,786		4,134

HOV and vanpool volumes were derived from the number of employee parking permits and registered participants for these vehicles. It was assumed that 38 percent of them would arrive during the peak hour following the overall campus inbound trip pattern. NIH shuttle trip counts were obtained directly from published schedules. Only those shuttles that had routes external to the campus were included. SOV volumes were determined by subtracting the other three mode volumes from the peak hour total. Shuttle occupancy was derived from monthly ridership data, and assumed that 22 percent of the arriving workday riders on each route came during the peak hour.

The computed APO is an underestimate in that it is assumed all non-employee traffic is in single occupant vehicles, that HOV vehicles have minimum occupancy, and that there are additional employees who Rideshare, but do not necessarily park in HOV assigned spaces.

The modal split covers all transportation modes, and is determined on a population rather than vehicle basis. The computation for the NIH modal split carries the APO estimates forward, and adds those who use non-vehicle modes. The estimated peak hour modal split is:

	<u>Peak Hour Arrivals</u>	<u>Percent by Mode</u>
Single Occupant Vehicle (SOV)	3,690	61.9
Transit	1,497	25.1
NIH Shuttle	242	4.1
High Occupancy Vehicle (HOV)	202	3.4
Pedestrian	189	3.2
Bicycle	54	0.9
Vanpool	50	0.8
Kiss and Ride	<u>34</u>	<u>0.6</u>
	5,958	100.0

Transit share is based on the percentage of the campus population that is enrolled in the campus TRANSHARE program. It represents both bus and Metrorail use, but may be an underestimate, since WMATA ridership surveys indicate the AM peak hour passenger exits from the Metrorail station alone are about 1,800. Pedestrian and bicycle arrivals are based on a one-time survey that extended from 7:30 AM to 9:30 AM.

5.3.6 Existing and Projected Traffic

Tables 5-13 and 5-14 show 1993, existing, and projected AM and PM peak hour traffic volumes, respectively. Data for 1993 is shown. More detailed information on turning movements and intersection configurations are given in Appendix G.

The existing volumes are those counted by intersection turning movement surveys taken in January 2004. Traffic was monitored throughout the AM and PM peak periods over a three day period with different intersections covered each day. The raw counts were aggregated into 15 minute totals, and the four highest consecutive totals summed to determine the peak hour. The surveys reveal complex peak period traffic patterns. The NNMC, NIH, and Bethesda CBD each produce peak hourly traffic at separate times within the overall three hour long peak period. Peak overall (NIH & background) hourly traffic volumes and subsequent congestion, occur at different times at different road links and intersections. The overall system AM or PM peak traffic hours are 8:00 AM to 9:00 AM, and 5:00 PM to 6:00 PM, respectively. These times are not concurrent with the NIH AM or PM peak hour traffic generation.

Comparison of 1993 and 2004 traffic indicates a decrease in traffic volumes on many roads links, but it should be noted that traffic volumes on Rockville Pike and Old Georgetown Road were 20 to 30 percent higher in the intervening years. This fluctuation is attributable to changes in background traffic, since the NIH trip generation semiannual surveys show declines from survey to survey. The changes in traffic flow on West Cedar Lane reflect the closing of the NIH entrances on that street after September 2001.

The 2003 MOU traffic volumes represent conditions that would currently exist if NIH had maintained its 1992 trip generation, and had not reduced trips through its TMP program. The 2003 MOU traffic volumes are equal to the 1992 NIH generated peak hour traffic (5,888 vehicles in AM peak hour; 5,772 vehicles in PM peak hour) superimposed on existing 2003 background or non-NIH traffic. The 1992 NIH traffic has been redistributed among the campus entrances to account for recent access changes. The 1992 MOU and 2003 MOU columns in Table 5-8 show the redistribution. NIH generated trips were redistributed on the peripheral road network in a corresponding manner. Traffic survey conditions are compared to the MOU reference conditions to determine potential impacts.

Analysis for future traffic projections was based on M-NCPPC Local Area Transportation Review (LATR) procedural guidelines. Projections include both NIH and background, traffic. Projections for future growth in background traffic were developed from information, provided by M-NCPPC staff, that is based on potential commercial and residential projects to the north and south of the campus in the Bethesda CBD and North Bethesda planning areas. The background projections assume all this development growth will occur, but no specific year is assigned to the projection. It was assumed that the Naval Medical Center would maintain its current trip generation level.

Three future NIH traffic projections were analyzed: the Master Plan and No Action Alternative, and the future MOU reference case. All three were superimposed on the same background traffic. The Master Plan Alternative projections add and disperse the traffic generated by a campus population of 22,000 using the January 2004 trip per employee generation rate. This assumes that future NIH TMP would continue with the same efficiency as in 2003.

Link		1993 Counts	2003 MOU REF	Jan 2004 Count	2020+ MOU REF	2020+ MP ALT	2020+ NA ALT
Rockville Pike (North of Cedar Lane.)	NB SB	1232 2973	1821 3396	1552 2662	2029 4231	1847 3689	1808 3452
Rockville Pike (South of Cedar Lane.)	NB SB	1237 3321	1771 4477	1467 3627	2088 5819	1882 5173	1846 4889
Rockville Pike (N. of Jones Bridge Road.)	NB SB	1273 2007	1225 2433	1102 2486	1849 3725	1690 3565	1634 3515
Rockville Pike (S. of Jones Bridge Road)	NB SB	1466 2414	1287 2873	1170 2754	1797 3898	1687 3105	1642 3093
Wisconsin Avenue (S. of Woodmont Avenue)	NB SB	1142 1679	1285 1755	1199 1654	1797 2742	1700 2715	1662 2710
Cedar Lane (East of Rockville Pike)	EB WB	214 1194	333 1307	298 1181	467 1789	442 1716	438 1684
West Cedar Lane (West of Rockville Pike)	EB WB	164 801	475 318	475 318	607 400	571 394	555 392
West Cedar Lane (E. of Old Georgetown Rd)	EB WB	532 398	432 393	432 393	567 393	546 393	509 393
Old Georgetown Rd. (N. of West Cedar Lane.)	NB SB	1139 3114	1088 3346	1000 2695	1531 4075	1393 3702	1370 3510
Old Georgetown Rd. (North of South Drive)	NB SB	1281 3018	1202 3451	1114 2800	1722 4106	1567 3737	1537 3575
Old Georgetown Road (South of Lincoln Drive)	NB SB	1297 2679	1205 1907	1033 1889	1607 2752	1469 2704	1411 2696
Old Georgetown Rd. (S. of Huntington Pkwy)	NB SB	847 2182	968 1984	894 1970	1377 2794	1295 2770	1262 2766
Greentree Road (W. of Old Georgetown Rd)	EB WB	512 205	648 225	535 214	595 244	538 223	512 221
Huntington Pkwy. (W. of Old Georgetown Rd)	EB WB	434 270	523 209	425 205	519 247	461 227	436 217
Jones Bridge Road (E. of Rockville. Pike)	EB WB	556 1401	482 1287	424 1022	519 1278	457 1104	448 1028
Woodmont Avenue (W. of Wisconsin Avenue)	SB NB	1214 359	1119 419	1101 388	1156 418	1122 404	1116 397
EB = eastbound NB = northbound MP ALT = Master Plan Alternative WB = westbound SB = southbound NA ALT = No action Alternative							

TABLE 5-13 1993, EXISTING, AND PROJECTED AM PEAK HOUR TRAFFIC ON ROADS SERVING NIH BETHESDA.

Link		1993 Counts	2003 MOU REF	Jan 2004 Count	2020+ MOU REF	2020+ MP ALT	2020+ NA ALT
Rockville Pike (North of Cedar Lane.)	NB SB	3811 1315	3862 2056	3270 1732	4381 2543	4057 2236	3906 2199
Rockville Pike (South of Cedar Lane.)	NB SB	4130 1428	4391 2212	3731 1842	5400 2998	5010 2612	4829 2566
Rockville Pike (N. of Jones Bridge Road)	NB SB	2913 1399	2876 2433	2756 1524	4157 2533	3983 2389	3927 2339
Rockville Pike (S. of Jones Bridge Road)	NB SB	2623 1452	2418 1781	2241 1695	3501 2638	3433 2543	3422 2498
Wisconsin Avenue (S. of Woodmont Avenue)	NB SB	2035 802	1834 1081	1682 1031	2942 1879	2828 1813	2872 1782
Cedar Lane (E. of Rockville Pike)	EB WB	1207 332	1219 344	1151 298	1790 613	1726 572	1696 567
West Cedar Lane (W. of Rockville Pike)	EB WB	1040 371	817 315	817 315	953 340	910 333	905 331
West Cedar Lane (E. of Old Georgetown. Rd)	EB WB	468 580	734 456	734 456	878 470	837 470	824 470
Old Georgetown Rd. (N. of West Cedar Lane.)	NB SB	2674 1509	2688 1440	2178 1300	3631 2086	3276 1883	3310 1851
Old Georgetown Rd. (North of South Drive.)	NB SB	2882 1581	2909 1376	2399 1236	3944 1984	3572 1805	3404 1784
Old Georgetown Rd. (South of Lincoln Drive)	NB SB	2294 1632	1871 1552	1740 1397	2670 2184	2598 2058	2587 2000
Old Georgetown Rd. (S. of Huntington Parkway)	NB SB	2062 1234	1854 1324	1785 1258	2695 1915	2654 1852	2647 1823
Greentree Road (W. of Old Georgetown. Rd.)	EB WB	246 522	279 560	263 508	304 604	272 553	268 529
Huntington Pkwy. (W. of Old Georgetown. Rd.)	EB WB	471 531	319 530	257 441	280 574	248 510	244 481
Jones Bridge Road (E. of Rockville Pike)	EB WB	1127 1067	1529 609	1066 558	1476 683	1198 587	1068 576
Woodmont Avenue (W. of Wisconsin Avenue)	SB NB	724 677	700 589	669 564	760 564	730 555	716 555
EB = eastbound NB = northbound MP ALT = Master Plan Alternative WB = westbound SB = southbound NA ALT = No action Alternative							

TABLE 5-14 1993, EXISTING AND PROJECTED PM PEAK HOUR TRAFFIC ON ROADS SERVING NIH BETHESDA.

The No Action Alternative is based on two percent growth in NIH campus population and related traffic. Comparison of Master Plan and No Action Alternative traffic data is indicative of potential traffic impacts associated with Bethesda campus population growth from 17,900 under the No Action Alternative to the 22,000 under the Master Plan Alternative. The MOU reference traffic volumes are those that would be present if NIH had not adopted its Transportation Management Program.

Most of the growth in future traffic volumes will be due to background traffic growth. This can be seen by comparing the 2003 and 2020+ MOU reference traffic volumes, which differ only in background volumes.

Once one is beyond the periphery of the campus, Master Plan Alternative link volumes are less than the MOU reference traffic levels on all roadways radiating away from the campus. The effects of maintaining NIH traffic generation below 1992 MOU levels, therefore, does not extend to roads and intersections beyond the area studied.

5.3.7 Intersections/Congestion

The level of congestion at an intersection is related to traffic volumes, signal phasing, number of lanes, and traffic movements permitted on each approach lane. Congestion increases as the volume of traffic approaches capacity. One widely used methodology for evaluating congestion is the Critical Lane Volume (CLV) method (Highway Capacity Manual, National Academy of Engineering Transportation Research Board, 2000). This method analyzes the intersection variables to establish a single number representative of the relative level of congestion.

The Montgomery County Annual Growth Policy (AGP) divides the County into some 25 transportation policy areas when independent cities are included. NIH Bethesda and all the intersections studied are located within the Bethesda-Chevy Chase policy area, which is coincident with the B-CC planning area. The Bethesda CBD policy area is located immediately to the south of the campus, and the Old Georgetown Road and Rockville Pike intersections with Battery Lane are in this area. The AGP establishes acceptable levels of congestion in each policy area in terms of intersection CLV. The CLV standards that have been adopted in the FY 2003 AGP for the Bethesda-Chevy Chase and Bethesda CBD policy areas are 1,600 and 1,800, respectively.

One of the goals of the MOU is that, as NIH undergoes further campus development, the level of congestion on roadways and at intersections serving NIH should be no worse than if the development did not occur. Intersection congestion will increase even if NIH maintains a constant number of site generated trips because of growth in background traffic. A comparative measure of congestion is needed to reflect this condition that changes with time. An "MOU intersection congestion impact" is defined as occurring if :

- The Critical Lane Volume of an intersection during either the AM or PM peak hour is higher for the Master Plan Alternative than the concomitant MOU reference condition and
- The Master Plan Alternative Critical Lane Volume is higher than the Montgomery County threshold value of 1,600 for acceptable congestion in the Bethesda-Chevy Chase area.

An intersection congestion and capacity analysis was conducted for each intersection around the NIH Bethesda campus, using the County LATR CLV methodology. Since NIH will maintain peak hour trip counts at or less than the MOU reference level of 1992, only those intersections adjacent to the campus can potentially be MOU intersections. They may be impacted by redistribution of NIH generated trips

among the NIH entrances due to redistribution of internal campus parking. All intersections beyond the periphery of the campus will have contributions from NIH traffic less than or equal to that contributed by NIH in the 1992 MOU traffic surveys.

Computed critical lane volumes for intersections in the vicinity of the campus are shown in Table 5-15 and Appendix G. The analysis for existing conditions was completed using traffic counts and turning movements as monitored in the January 2004 traffic survey as well as the existing intersection configuration.

The analysis for future conditions incorporates anticipated near term NIH and County changes in intersection operations or improvements. They include:

- Lincoln Drive/Old Georgetown Road - Change the NIH Lincoln Drive entrance from two lane, two way operation to two lanes, one way outbound at the intersection.
- South Drive/Old Georgetown Road - Change South Drive from two lanes outbound, one lane inbound operation to two lanes inbound at the intersection.
- West Drive/West Cedar Lane - Change West Drive from normally closed to one lane one way inbound.
- North Drive/Rockville Pike - Change North Drive outbound lane from left turn - right turn operations to right turn out only. Eliminate the left turn movement from northbound Rockville Pike into North Drive.
- Commercial Vehicle Inspection Facility/Rockville Pike - Add new right turn in only entrance on southbound Rockville Pike opposite to the NNMC north entrance between North Drive and Wilson Drive.
- Jones Bridge Road/Rockville Pike - After consultation with the Montgomery County DPW&T, County proposed second exclusive left turn lanes were added to southbound Rockville Pike, and to westbound Jones Bridge Road.

In general, overall existing congestion at intersections around the periphery of NIH is less than what was in 1993. The Critical Lane Volume exceeded 1,600 at six intersections in 1993 during at least one peak hour. In 2004, only one intersection, Rockville Pike at Cedar Lane, had a CLV above 1,600. Since background traffic has increased, the reduction in congestion over the interim decade is attributable to a reduction of over 2,000 AM peak hour and over 2,300 PM peak hour NIH generated trips during the LATR study times.

Traffic volumes and congestion will increase on all roads around the campus over the next 20 years, even if NIH trip generation remains unchanged. This is indicated in Table 5-15 by a comparison of 2004 and future MOU reference conditions, where NIH trip generation is held constant. The increased congestion is due to growth in background or non-NIH traffic. Projects that would add about 10,000 jobs and 2,000 residential units to the Bethesda CBD and Friendship Heights were in the development process pipeline in 2002 (County FY 2003 Annual Growth Policy). Similarly, pipeline projects in the North Bethesda and White Flint policy areas were expected to add another 10,000 jobs and more than 2,300 residential units.

The No Action Alternative CLV values indicate the effects of future background traffic growth. Under this alternative, NIH generated traffic is increased by only two percent from existing levels, and while some minor shifting of NIH commercial and visitor traffic from Old Georgetown Road to Rockville Pike occurs, most of the increase in future CLV levels is attributable to background traffic. The number of intersections with Critical Lane Volumes above 1600 in at least one peak hour would increase to eight. Six of these intersections are in the Rockville Pike corridor.

INTERSECTION	1993	2004 MOU REF	EXISTING JAN 20004	FUTURE MOU REF	FUTURE MASTER PLAN	FUTURE NO ACTION
Old Georgetown Road @ West Cedar Lane	1611/1690	1538/1591	1298/1402	1835/2026	1698/1864	1638/1795
Old Georgetown Road @ Center Drive	1266/1421	1114/1355	947/988	1469/1892	1197/1560	1172/1452
Old Georgetown Road @ South Drive/Greentree Road	1651/1383	1398/1280	1162/998	1447/1417	1370/1227	1342/1189
Old Georgetown Road @ Lincoln Drive	1211/1430	1157/1417	820/1065	1299/1592	1272/1406	1417/1233
Old Georgetown Road @ Huntington Parkway	1417/1227	1256/1183	1209/1068	1704/1501	1646/1416	1637/1383
Rockville Pike @ Cedar Lane	1683/2154	1947/2054	1614/1973	2540/2592	2283/2404	2169/2339
Rockville Pike @ North Drive*	1380/1776	1616/1498	1299/1223	2106/1828	1864/1643	1759/1597
Rockville Pike @ Commercial Vehicle Insp.* NNMC Entrance	--	---	1104/1386	1806/2079	1614/1934	1531/1867
Rockville Pike @ Wilson Drive	1105/1579	1626/1551	1200/1266	1951/1957	1693/1776	1595/1692
Rockville Pike @ South Drive	1005/1642	1586/1645	1218/1446	1980/2132	1730/1989	1638/1925
Rockville Pike @ Gateway Center*	--	--	--	1424/1617	1340/1529	1318/1498
Rockville Pike @ Center Drive/Jones Bridge	1901/2589	1498/1879	1230/1480	1804/2020	1632/1811	1570/1717
Wisconsin Avenue @ Woodmont Avenue	938/1182	871/988	817/919	1236/1385	1218/1358	1213/1354
West Cedar Lane @ West Drive/Locust Avenue	887/705	CLOSED	CLOSED	537/868	498/813	CLOSED
* Unsignalized 1000/1000 = Critical Lane Volumes (AM Peak Hour/PM Peak Hour)						

TABLE 5-15 INTERSECTION CRITICAL LANE VOLUMES.

The NIH Commercial Vehicle Inspection Facility (CVIF) entrance will be located opposite the north entrance to the National Naval Medical Center (NNMC). Vehicle movements at the CVIF will be limited to right turn inbound. The relatively high CLV at this unsignalized intersection is due to traffic entering and leaving the NNMC. It was assumed that NNMC traffic volumes would remain constant.

The Master Plan Alternative does not add any intersections with Critical Lane Volume greater than 1600 to the No Action total. However, the AM CLV would increase from below 1600 in the No Action case to above 1600 in the Master Plan case at three intersections on Rockville Pike (CVIF, Wilson Drive, and Center Drive/Jones Bridge Road). The CLV is higher during the PM peak hour at each of these intersections. A similar situation would occur at the Rockville Pike/North Drive intersection during the PM peak hour, even though NIH traffic will be limited to right turn in-right turn out at this intersection.

The Master Plan Alternative CLV levels assume a 22,000 employee population and full build out of the campus. Actual CLV levels would be intermediate between the No Action and Master Plan values depending on the extent of campus population growth.

The Master Plan CLVs are less than the future MOU reference levels in all cases, and the no MOU intersection congestion impacts are anticipated.

5.3.8 NIH Parking

The number of parking spaces at NIH Bethesda fluctuates continually. Ongoing construction of buildings and utilities adds and deletes spaces or removes access to spaces, on a permanent or temporary basis. The last formal survey of campus parking completed in September 2002, counted 9,700 spaces. The data shown in Table 5-16 advances the baseline conditions to 2003, and accounts for space adjustments due to ongoing construction at the Family Lodge, the new Hatfield Clinical Research Center, and at Building 6.

Employee parking at NIH Bethesda is controlled by several parking space classifications designated by permit. For each classification, NIH employees receive rear view mirror parking tags of a certain color.. All NIH employee spaces are not necessarily available to the entire campus employee population. Preferential employee spaces are set aside for high level administrative and technical personnel whose jobs require immediate space availability particularly during the midday when spaces are at a premium. Reserved spaces are used by fire, police, and emergency response personnel, by official vehicles travelling daily between NIH Bethesda and NIH facilities in Poolesville, Frederick, and Baltimore, and by contractor vehicles. Other spaces are designated for carpools and vanpools, and the handicapped. Remaining NIH employee spaces can be used by NIH employees with general parking permits. Additional spaces are set aside for government interagency carpools, residents who live on the north side of the campus, as well as the many visitors to the campus.

Of 9,356 parking spaces on campus in 2003, only 8,149 were allocated to NIH employees. Of these, only 6,163 were available for general employee use. There were an additional 575 parking spaces reserved for NIH employees at satellite lots. The Mid Pike Plaza lot is connected to the campus by NIH shuttles. Spaces at the Shady Grove and New Carrollton Metro stations are available only for employee transit users. If satellite and on-campus parking are combined, about 8,700 spaces were available to NIH employees in early 2003.

In contrast to many federal facilities, NIH Bethesda attracts a large number of visitors to the campus. This is attributable to the Clinical Center hospital and outpatient facilities, and the dispersion of NIH extramural research administration facilities elsewhere in Montgomery County. Activities lead to an estimated 5,000 daily visits to the campus, when trips to the campus by NIH employees working elsewhere are included. Campus visitor parking has been consolidated at four locations: Lot 4A on the south side of Building 31, MLP-8, Building 45, and under Building 10. Operations have been shifted to managed and pay parking.

Campus parking is continually reported as saturated by periodic parking occupancy surveys dating back to 1989. Parking remains saturated as indicated in the following which summarizes an occupancy survey conducted in April, 2001:

<u>Space Type</u>	<u>Occupancy</u>
General NIH Employee	108.2%
Preferential NIH Employee	98.4
Reserved NIH Employee	70.0
NIH Carpool/Vanpool	99.5
Handicapped	82.6
Visitor/Patient	99.0
Government Vehicle	<u>48.7</u>
Overall	102.0%

Occupancy greater than 100% is achieved through attendant parking, parking in lot aisles, or drivers waiting for an available space.

		<u>Spaces</u>
A. NIH BETHESDA CAMPUS PARKING SPACES BY ASSIGNMENT		
NIH Employee Parking by Permit		
General NIH Employee	6,163	
Preferential NIH Employee	919	
Reserved NIH Employee	238	
NIH Carpool/Vanpool	542	
NIH Handicapped	<u>287</u>	
Total Employee		8,149
Loading Dock/Service	138	
Government Vehicle, On-Campus Residents, Special Purpose	<u>358</u>	
		496
NIH Visitor		
General Visitor	447	
Patient/Patient Visitor (Clinical Center P3 Lot)	264	
Total Visitor		<u>711</u>
Total NIH Bethesda		9,356
B. OFF CAMPUS PARKING		
Mid Pike Plaza (North Bethesda)	400	
Shady Grove Metro (Shady Grove)	150	
New Carrollton Metro (Prince George's County)	<u>25</u>	
Total NIH Off Campus		575
C. CONSTRUCTION CONTRACTOR PARKING		
Pooks Hill	<u>150</u>	
Total Employee		150
Total		10,881

TABLE 5-16 NIH PARKING DATA.

NIH has no authority over employee actions beyond the campus limits. If campus parking demand exceeds supply, the pressure to park off campus in adjacent neighborhoods increases. Reductions in the employee parking ratio must be done cautiously to maintain a balance between employee campus requirements, and County and Federal objectives to control parking on federal sites.

Since 1993, NIH has conducted a vigorous employee awareness program through the campus newspaper, about the importance of avoiding parking in adjacent residential neighborhoods. New employees learn about the situation at monthly TMP orientation meetings, where TMP alternatives such as transit and satellite parking are identified. NIH limits construction contractor parking spaces on the campus, but maintains 150 spaces dedicated to contractor use at Pooks Hill.

The general standard for parking at federal facilities in the Washington suburbs near Metro stations is 0.50 parking spaces per employee (Comprehensive Plan for the National Capital Federal Facilities Element, NCPC, 1989). Parking for agency visitors, government vehicles, loading, police, emergency vehicles, and other special uses is not subject to the standard. The current employee parking ratio at NIH Bethesda is 0.47 spaces per employee (8,149/17,511), down from 0.54 in 1995.

The NIH parking strategy for the future will include a full spectrum of parking options, transportation management measures, and long term solutions. Options for adding spaces when needed are increased stacked parking, temporary surface lots, and new multilevel parking structures (MLPs). These would be implemented in conjunction with increased use of satellite lots, and offset by the gamut of TMP measures such as TRANSHARE, express bus service, carpool/vanpool, and bicycling to maintain alternative mode of travel usage at existing levels.

The pace of reduction in the NIH employee parking ratio is dependent on many factors, some of which are beyond the control of NIH. The NIH has already significantly reduced the number of employee peak period vehicle trips through its TMP program. The NIH TMP program has already achieved the “easy” trip reductions from the 1992 MOU reference traffic levels. A significant portion of the NIH employees who live along the Red Line west leg corridor already use Metrorail and participate in TRANSHARE. About 23 percent of the employees are in the TRANSHARE program.

The Master Plan Alternative is based on the NCPC Comprehensive Plan policy of maintaining the employee parking space per employee ratio of 0.50 or less, with a long term goal of reducing the ratio further to 0.45 on a permanent basis at full Master Plan buildout with a 22,000 campus employee population. Achieving and maintaining these ratios is dependent on implementation and enhancement of regional Washington and suburban Maryland facilities and programs, such as HOV lanes on I-495 and I-270, new transit facilities such as the “purple line” and the Georgetown trolley, park and ride lots, NIH daily operational exigencies, and availability of Congressional funding for campus parking projects and TMP measures. Under the Master Plan Alternative, no new employee parking spaces would be added to the buffer, and those now in the buffer would be removed. The Visitor Center parking garage will be located in the buffer because it must be outside the security perimeter.

The parking ratio may exceed 0.50 temporarily under several circumstances. New MLPs proposed in the Master Plan range from 350 to 1,520 spaces (MLP-D). A sharp jump in the campus parking ratio will occur in the interval between the MLP opening for service, and the demolition of surface spaces. An MLP of 1,000 spaces, for example, would increase the existing ratio by 0.057 (1,000 spaces/17,511 employees) on the day it opened. The ratio would return to levels below 0.50 with the removal of parking that the MLP replaces, in whole or in part. Funding for parking projects can be difficult to obtain. Proposed MLPs generally replace several surface lots. These lots may not be removed in conjunction with the new MLP because of funding. They also may not be removed simultaneously, but in sequence as funding is obtained. Although the Master Plan calls for MLP construction at sequenced intervals, it is

possible that two may be built at the same time. In such a case, the ratio may be affected temporarily by 10 percent or more.

Currently, 4,888 of the 9,356 campus spaces are in surface lots and 4,468 are in MLPs or other structure parking, primarily Building 10. Under the Master Plan, the number of surface spaces would be reduced to 1,508, mostly through buffer area removal, while the total number of spaces would increase to 12,249. Of these, about 10,512 would be for employees, for a parking ratio of 0.48. Parking in structures would increase from 4,468 to 10,741 with the construction of all proposed MLPs and structural parking.

The projected number of 2020 Master Plan visitor spaces is 1,237. Of these 350 would be located in a garage at the Visitor Center along Rockville Pike. An additional 160 visitor spaces would be added at MLP-9. The 264 patient visitor spaces under the Clinical Center would be retained. The remainder of the visitor spaces would be interspersed throughout the campus. Government vehicle and loading dock spaces would remain at around 500.

Under the No Action Alternative, future campus parking would be maintained using the criteria of 0.50 spaces per employee based on an ultimate No Action employee population of 18,400, plus six percent of employee spaces for visitors, plus 500 spaces for government and other vehicles, or about 10,000 total spaces. The No Action Alternative includes construction of MLP-9, MLP-10, and the Visitor Center garage, which are either under design or construction. These projects will provide 2,500 additional parking spaces in structure, permitting a concomitant number of surface space removal.

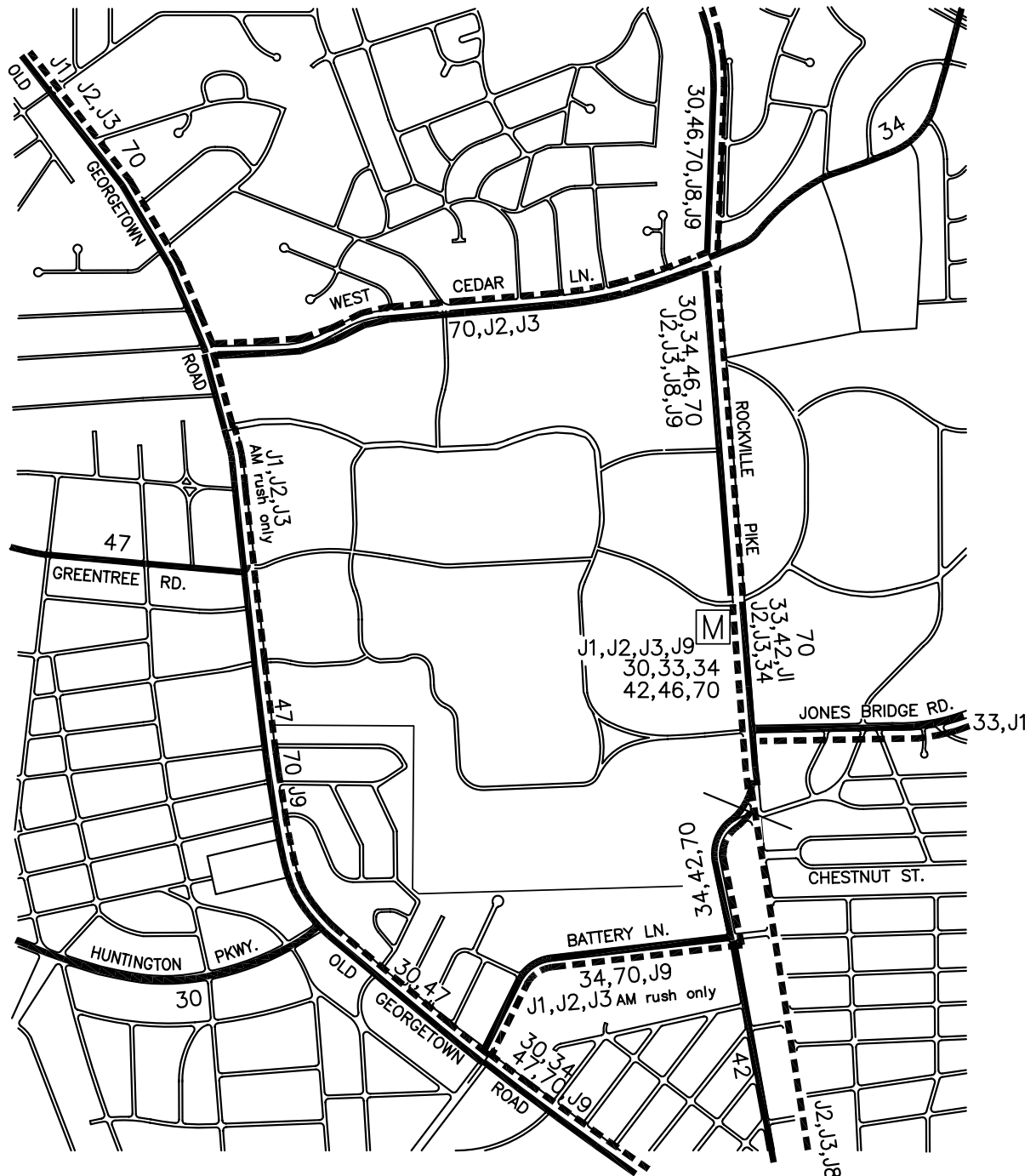
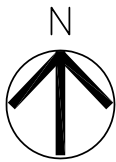
Off campus spaces would vary under both Alternatives as TMP circumstances dictate.

5.3.9 Transit

NIH is located on the Washington Metropolitan Area Transit Authority (WMATA) Red Line of the Washington Metrorail rapid transit system. The line passes NIH in a tunnel and is accessed via the Medical Center station on the east side of the campus on Rockville Pike at South Drive. The station is located underground between South Drive and Jones Bridge Road just to the east of Rockville Pike. On average, approximately 8,200 Metrorail riders board or alight at the station each day based on WMATA ridership surveys. Between 5:30 AM and 9:30 AM, 2,844 riders use the station. Of these, 62 percent or 1,777 arrive at the station on work destination trips (1992 Metrorail Passenger Survey, WMATA Planning Dept., 2000). The Medical Center station ranks 45th out of 70 stations in passenger counts, and has a comparatively high use for a station with no associated dedicated parking. Except for the Shady Grove station, ridership exceeds that of all Metrorail stations to the north of NIH on the west leg of the Red Line.

The Medical Center station has a bus transit transfer station on the surface. WMATA Metrobus and Montgomery County Ride-On both operate buses to and through this station (Figure 5-10). Transit service at the station has undergone a transformation over the last two years. Seven bus routes that passed through the campus prior to September 2001, now make circuits around the periphery.

Metrobus has four routes serving the campus. The J1 route provides rush hour only service between the Metrorail station in Silver Spring and the NIH campus via Jones Bridge Road on 30 minute headways. Scheduled trip time to Silver Spring is 20 minutes. The J2 and J3 routes offer through service between the Silver Spring Metrorail station and Montgomery Mall with intermediate stops in the Bethesda CBD and at the Medical Center station. Headways are 7 minutes during rush hours and 20 minutes at other times. Trip times are 24 to 28 minutes to Silver Spring and 18 to 22 minutes to Montgomery Mall. These bus routes have a ridership of about 7,000 passengers per day. About 4,000 of these passengers have



Metrobus Routes (J1,J2,J3,J8,J9)

RIDE ON Routes (30,33,34,42,46,47,70)

Note: RTE 70 AM rush southbound Rockville Pike, northbound Old Georgetown Rd only
 RTE 70 PM rush northbound Rockville Pike, southbound Old Georgetown Rd only

FIGURE 5-10 BUS TRANSIT SERVICE AT NIH.

origins and destinations at the Medical Center station.

New Metrobus service includes the J8 and J9 routes. The J9 is one of two lines that comprise the “I-270 Express”. It runs between the Lake Forest Transit Center in Gaithersburg and the Bethesda Metro station. An intermediate stop is made inbound or southbound, at the Medical Center station in the morning rush period, and outbound in the evening. The companion J8, I-270 Express, line passes NIH on Rockville Pike but makes no intermediate stops between its route end terminals

Montgomery County operates the local Ride-On Bus system. Seven Ride-On routes serve the campus. All but one, Route 47, stop at the NIH Medical Center transfer station. Route 30 is a local collector route that circles through neighborhoods to the north, west, and south of the campus before terminating at the Bethesda Metrorail station. Routes 33 and 34 provide rush hour only service to Wheaton Plaza via separate routes. Route 42 provides service to Friendship Heights via Woodmont and Wisconsin Avenues. Route 46 connects NIH with Rockville via Rockville Pike on 20 minute headways and primarily serves as a feeder to Metrorail stations along this route. Route 47 runs between the Rockville and Bethesda Metro stations via Montgomery Mall, and passes the campus on Old Georgetown Road northbound. Route 70 is a new express service running between the Germantown Milestone park and ride lot and Bethesda. The route follows Rockville Pike northbound, but returns via Old Georgetown Road, West Cedar Lane and Rockville Pike. These Ride-On bus routes collectively carry about 7,600 passengers per day (MC DOT Office of Planning and Project Development).

Heavy rail commuter service is available via the Maryland Rail Commuter (MARC) “Brunswick” line. Trains originate in Martinsburg, West Virginia, or Brunswick and Frederick in Maryland, and travel to Union Station in Washington, D.C in the AM hours with reverse movements occurring in the evening. MARC currently operates nine trains inbound to Washington in the morning and ten outbound in the evening. All stop in Rockville about six miles to the north of NIH Bethesda, where a connection can be made to the Metrorail Red Line.

The NIH TRANSHARE program provides subsidies to NIH employees to offset transit costs. To participate in the program, members must yield their employee parking tags. Only full-time employees are eligible. The current subsidy is as much as \$100 per month.

Employee transit use has grown steadily under the NIH TMP TRANSHARE program since 1995, when 2,000 employees participated. Participation has increased with 3,971 employees enrolled in 2003, despite the severance of public bus routes through the campus. Actual transit use is higher. Employees not enrolled in the program use transit occasionally. Several hundred summer student intern researchers may not park on the campus and, as a condition of employment, although they are eligible for TRANSHARE. Most use transit to reach the campus.

Under the Master Plan Alternative, the existing transit mode share for home-work trips is assumed to continue at the same proportionate rate. If this occurs, the number of TRANSHARE program participants would increase to about 5,400 when the employee population grows to 22,000. Further increases in the percentage of employees using transit are limited unless outside plans and proposals such as the circumferential “Purple” transit line are implemented.

5.3.10 NIH Shuttle Service

NIH operates several shuttle bus services under contract that link the campus internally and provide free service to off-campus NIH facilities and parking. The NIH shuttle bus fleet includes eight 20-passenger buses, eleven 15-passenger vans, and two lift-equipped 14-16 passenger vans for those confined to

wheelchairs. For special events and deliveries, there are two lift equipped 24-passenger buses. Lift equipped vans connected to this service are also available to the handicapped on advance request. A phone is available at the NIH information kiosk at the entrance to the Medical Center Metrorail transfer station to permit handicapped transit riders to call for handicap equipped NIH vehicles. Most of the shuttle routes do not run on holidays or weekends.

NIH shuttles carried about 800,000 passengers in 2003. The NIH internal campus shuttle carried 302,814 riders during this period, or an average of about 1,226 per operating day. It runs on a ten minute headway. The four stops with the highest ridership in the order of number of boardings were: the Metrorail station, Building 31, Building 10, and Building 36. NIH initiated a second internal campus route, the NIH Campus Express, in September 2003. It follows a similar route to the campus shuttle, but bypasses the Metrorail station to provide faster service between campus buildings. It operates on 15 minute headways. Ridership increased from 115 per operating day under initial operations to 310 in December. A separately funded shuttle extends service between the Metrorail station and Clinical Center via Building 31 until 8:00 PM. A shuttle also provides service for patients and family members between the Children's Inn and Clinical Center. These two internal routes carried an additional 46,763 riders during 2003. On call campus shuttle service is also available until 12:30 AM.

Six off-campus routes and patient shuttle service are also available. Five of these off-campus routes connect the Bethesda campus to NIH satellite facilities and primarily transport NIH employees among them. The first of these travels between the campus and NIH facilities in the Gateway Building in the Bethesda CBD. The second, the Executive Plaza shuttle operates between NIH and four buildings with NIH offices in the Executive Plaza complex about four miles to the north of the campus. Other intrafacility shuttles travel between NIH and facilities on Rockledge Drive to the east of Montgomery Mall, and to the US FDA Parklawn offices. Services on all these external routes run from approximately 6:30 AM to 6:30 PM on work days. Headways of 15 to 20 minutes are maintained during the morning and evening rush hours, and 30 minutes during midday. The last external shuttle of this type runs four times a day to Fort Detrick in Frederick, Maryland, about 25 miles to the north. These external employee shuttles had a combined ridership of over 245,000 in 2003. The sixth external shuttle carries employees to and from satellite parking at Mid-Pike Plaza. Ridership was 141,164, or 572 per operating day. In addition to these shuttle services, other on-call shuttles transport Clinical Center and Children's Inn patients and family members between the campus, and Reagan National, Dulles, and BWI Airports, as well as local hotels in Bethesda. Ridership was over 43,000 in 2003.

It is estimated that all the external shuttles combined eliminate about 1,540 vehicle trips to the campus each day. This cuts the average daily traffic flow through the campus entrances by about four percent.

All of the shuttle services would be retained under the Master Plan and No Action Alternatives with route and stop alterations made as circumstances and ridership dictate. The existing internal campus route generally follows the path of the future Loop Road, but temporarily diverges to service Building 10 on the south side, while the new Hatfield CRC is under construction, and the south parking lot. Route changes will occur when construction of the Hatfield CRC is completed around 2004 (Figure 5-11). Under both Alternatives, campus security requirements will separate internal and external campus shuttle routes with neither crossing the security perimeter. All external shuttles will be routed to a campus shuttle loop at the South Drive entrance on Rockville Pike where and riders will transfer between shuttles.

Campus shuttles will have increasing functional importance under both Alternatives. More employees will use transit even if the proportion doing so remains the same. General visitors will be directed to the Gateway Center on the periphery. The internal campus shuttle will take on increasing importance in the dispersal and collection of transit station and Gateway Center arrivals throughout the campus.

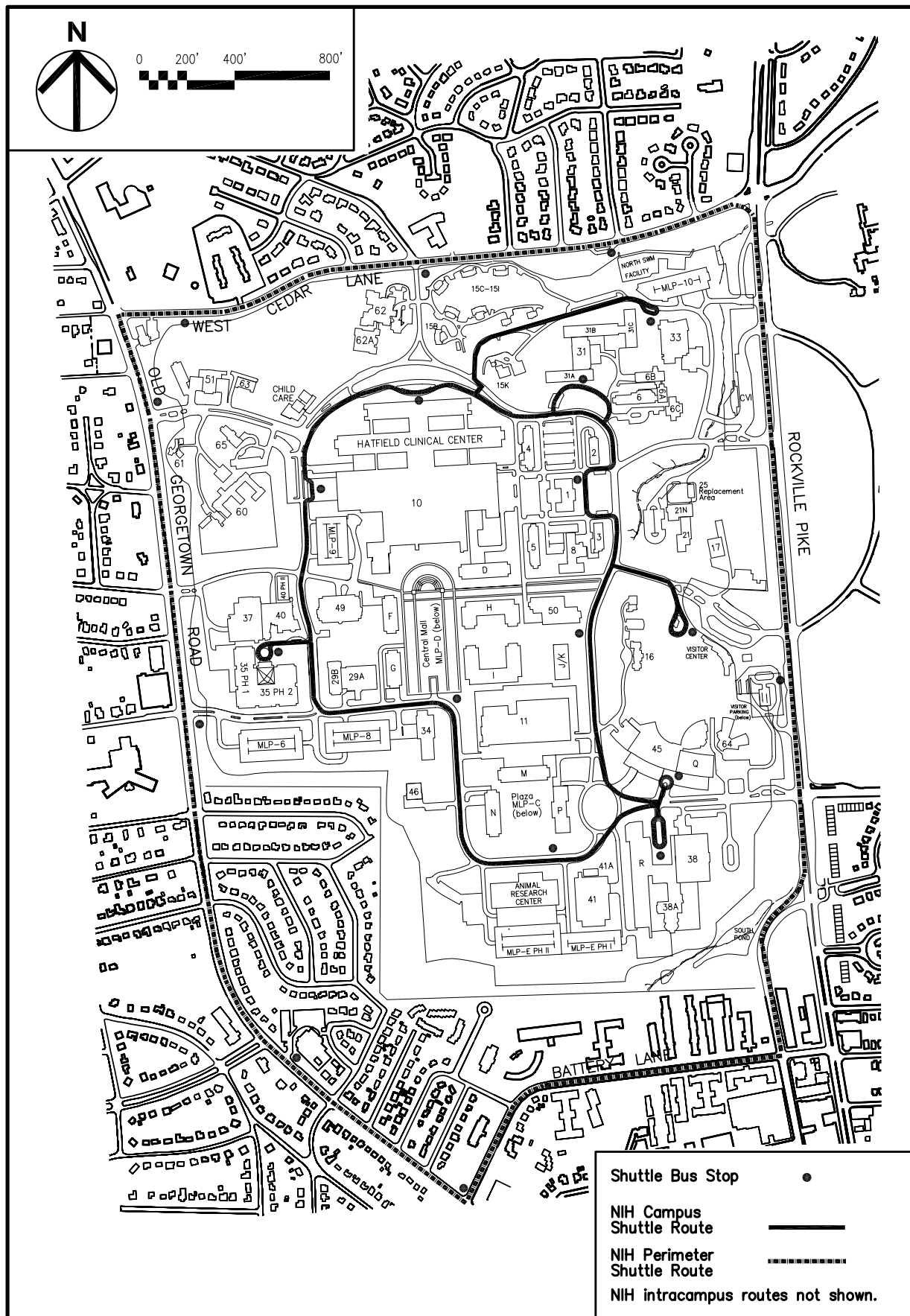


FIGURE 5-11 NIH PERIMETER AND FUTURE INTERNAL CAMPUS SHUTTLE ROUTES.

In November 2003, NIH introduced a new local area external shuttle route, which is available to both employees and the general public. The route makes a clockwise circuit around the periphery of the campus via Rockville Pike, Battery Lane, Old Georgetown Road, and West Cedar Lane with a 20 minute headway. Eight stops are located along the route. Residents along the route can use this perimeter shuttle to travel to and from the Medical Center Metrorail station.

5.3.11 Pedestrian/Bicycle Access

The Bethesda-Chevy Chase Master Plan endorses the expansion of pedestrian paths and bikeways to form a network linking residential neighborhoods with public facilities. Such an expansion is an important step that generates opportunities to reduce automobile use and provide transportation alternatives. The Plan recommends that a vigorous program be pursued to implement the County Master Plan of Bikeways within the Bethesda-Chevy Chase planning area.

The Bethesda CBD Sector Plan proposes a more formal bikeway connection to the southern boundary of the NIH campus near Stony Creek. The existing path through Battery Park would be extended to right-of-way on Norfolk Avenue in the Woodmont Triangle to reach the center of Bethesda and other points in the Bethesda CBD. Connections would be made to the Capital Crescent Trail that follows the old CSX Georgetown Branch right-of-way, linking the Silver Spring and Bethesda CBDs, the C&O Canal, and Georgetown.

The County Master Plan of Bikeways proposes bicycle routes along Rockville Pike, Old Georgetown Road, Cedar Lane, Greentree Road, and Sonoma Road. In most cases existing sidewalks would be used. The Bethesda-Chevy Chase Master Plan notes that it is important that NIH provide the bicycle path segments around the perimeter of the campus as shown in the Master Plan of Bikeways.

An existing pedestrian/bicycle path follows the NIH Stream through the Locust Hills neighborhood. It connects the northeast corner of NIH to the main bikeway and hiking path in Rock Creek Park about half a mile to the northeast. This is a popular access route between Bethesda and the park for recreational users. The County is in the process of creating the North Bethesda Trail through construction interconnecting existing segments.

In the past, the Bethesda campus was freely accessible at any point along its perimeter to pedestrians and bicyclists except for fencing its fenced southern boundary. However, a new perimeter fence was installed in 2003 in response to new security requirements. Foot access is currently limited to 13 entry points through the security perimeter, nine of which will accommodate cyclists (Figure 5-12). Eight of the entry points are at vehicle entry locations. The remaining five, including two in the south side buffer, will be for pedestrians and bikers only. A publicly accessible NIH pedestrian trail running the length of the south side buffer between Old Georgetown Road, and across Woodmont Avenue to Rockville Pike, has been constructed as part of the security perimeter fence installation. A future fourteenth entrance at the Gateway Center will be available for campus visitor vehicle access only.

Both alternatives encourage and allow for County trails around the perimeter of the campus. Internal campus walkways or bike paths tie to the County system. The thirteen pedestrian entryways are still available to the general public to transit the campus. However, in the future, with one exception, access at the entry points will be limited to NIH employees via an electronic card system. Campus visitor pedestrian and biker traffic will be routed to the Gateway Center entrance on Rockville Pike at South Drive to pass through a security checkpoint. Those arriving by Metro or surface transit will also enter the campus at this point. Visitor pedestrian or biker departures could be by any entry point.

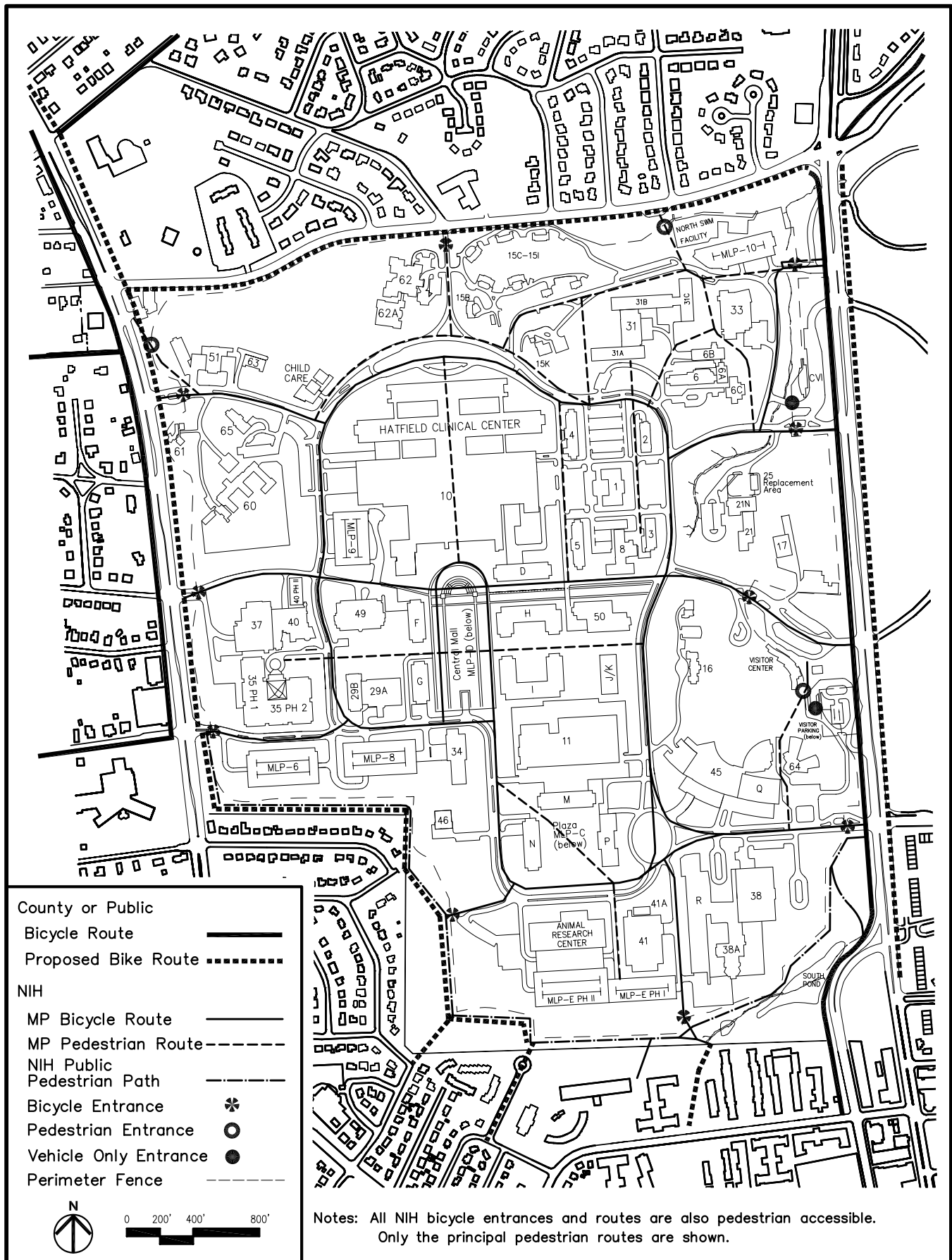


FIGURE 5-12 NIH AND PUBLIC MASTER PLAN PEDESTRIAN/BICYCLE ROUTES.

NIH Bethesda now has about 600 securable bicycle spaces in racks and lockers around the campus. An important feature of the Master Plan Alternative is greater emphasis on pedestrian travel internally around the campus. Except for emergency and a few service vehicles, automobile and truck access will be limited in the central core of the campus inside the Loop Road, an area equivalent to about sixteen city blocks. Organization of the campus into landscaped quads and malls, with interconnecting paths and walkways will encourage more pedestrian activity. In the Master Plan Alternative, the number of employees who would work within 1,500 feet of the Metrorail station entrance or eight minutes walking distance from the station would be increased from about 4,100 to 7,200.

NIH will cooperate with the County on resolving trail issues. Montgomery County has included funding for design and construction of the North Bethesda Trail, formerly identified as the Tenallytown Trolley Trail in its Capital Improvement Program. Completion of the trail is scheduled for 2004. The trail passes through Maplewood to the north of NIH, then down Old Georgetown Road to Lincoln Drive. The County Master Plan of Bikeways proposes that it follow the NIH buffer across the southwest corner of the campus to link to the Woodmont Triangle. NIH has built a public pedestrian trail along the south buffer. Upgrading the path to a bike trail conforming to County standards would be the responsibility of the County.

5.3.12 Future NIH Transportation Management Program

A primary goal of the NIH TMP is to mitigate NIH generated traffic impacts such that the contribution of NIH to the level of congestion on public roads is no worse than it was in 1992 when the Memorandum of understanding (MOU) establishing the program was signed. Over the intervening decade, TMP activities have aggressively pursued the reduction in employee single occupant vehicle traffic. These include public transportation programs, ridesharing, and development of off-site parking facilities.

One measure of conformance is the rate of vehicle trip generation per employee that is reflected by campus entrance trip counts. NIH is committed to generating no more peak hour trips than were prevailing at the time the MOU was signed in 1992. On this basis, a site limitation of 5,888 AM peak hour and 5,772 PM peak hour trips was established.

The success of the NIH TMP is revealed by the October 2003 monitoring survey. The total recorded AM peak hour entrance traffic volume was 4,190, while the PM peak hour value was 3,159. These figures represent reductions of 29 and 45 percent from 1992 counts, respectively. The reductions were realized despite a campus population increase from 16,350 to 17,500 at the time of the respective monitoring surveys. Another measure of TMP effectiveness is TRANSHARE participation, which has increased from about 1,000 employees in 1992, to about 2,000 in 1995, to over 3,700 in 2003.

The decline experienced in vehicle trips through the entrances more than offsets the number of trips that would be added by an employee population increase from 17,500 to 22,000 as proposed in the Master Plan.

NIH is committed to continuing and enhancing its TMP measures to control vehicle trip generation and parking. Future TMP measures would be applicable to the Master Plan and the No Action Alternatives. For analytical purposes, it is assumed that TMP will continue at the same rate of effectiveness, i.e. trips per employee, as the existing TMP. (See Section 5.3.4 for existing TMP summary). The program undergoes periodic monitoring and review in the context of evolving regional and campus transportation conditions. Future measures are also explored, and evaluated for feasibility, cost, and effectiveness at NIH Bethesda, as they are developed.

Some measures currently in place or under consideration are:

- Electronic signs at campus shuttle stops that provide “real time” arrival information. WMATA is installing such a system at some Metrorail stations.
- Federal agency shared parking program.

This concept is intended as a measure to reduce regional vehicle pollutant emissions. Under the program, the employees of a federal agency would be encouraged and allowed to park at the facilities of a second agency closer to their home. They would then use transit to continue their trip to work. For example, an NIH employee would be allowed to park at the Suitland Federal Center in Prince George’s Maryland, and vice versa. The program would reduce regional vehicle miles traveled. Emphasis in the program is placed on reducing traffic on the I-495 Beltway. Each agency would maintain a bank of parking spaces, and trade spaces with other agencies so that there would be no net change in facility portal trips.

- Managed Parking Expansion

Managed parking increases space use efficiency, discourages illegal parking, and enhances security around garages and lots.

- Transit Promotion and Marketing Enhancement

NIH continues to look for ways to increase transit use. Since 1995, NIH has worked cooperatively with local jurisdictions and transit agencies to establish four new express bus routes serving the campus. Other opportunities and routes are evaluated as they develop. NIH is evaluating how promotional measures employed by Transportation Management Associations around the region may be applied at NIH. An example is merchant or restaurant discounts for TRANSHARE program members.

- Increased Employee Carpools

Regional transportation improvements will increase the attractiveness and potential use of HOV. The widening of I-270 will extend HOV to Frederick and include the construction of park and ride lots within the corridor. The I-495 Beltway widening, now in the study stage, will add bidirectional HOV lanes while the number of general travel lanes will remain the same.

- Employee Education

NIH will continue to expand the ETSO educational effort. Providing information on bicycle trails in the vicinity of NIH on the ETSO website is currently being evaluated.

5.4 UTILITIES

Extensive infrastructure such as roads, utilities, and support facilities are needed for campus operations. Planned improvements to infrastructure are guided by the NIH Infrastructure Modernization Program (IMP). The IMP covers infrastructure modernization needed to upgrade facilities to meet current conditions as well as Master Plan growth. Many of the improvements are necessary in the No Action Alternative. The NIH Bethesda Master Utilities Plan (MUP) is a part of the IMP which provides a planned program for improvements to central utilities, including central heating and cooling generation and distribution. Secondary utilities, which include water, sanitary sewer, storm drains, electric power and gas, are also covered by the IMP. In the interim, since 1995, many of the central plant and utility infrastructure projects proposed in the IMP and MUP have been implemented or are underway.

Similarly, several major research laboratories and the Clinical Research Center replacement have been built or are underway. Some Master Plan planning premises such as campus population and space allocation by type of use have been revised. The original 1992 MUP has been updated to reflect these changes (Master Utility Plan: 2000 Update, Mueller Associates II, Inc./TA Engineering, Inc., 2000). The updated Master Plan is referred to as the UMUP herein.

Future No Action Alternative utility demand projections assume implementation of the projects shown in Table 4-3. The listed projects are “committed” projects in that they are either in the design or construction phase, or they will be required by known exigencies (e.g. the Gateway Center and Research Building 33).

Projected demands are based on existing utility consumption or demand rates. They do not account for energy conservation measures, such as those given in Section 5.11 that may be implemented over the next 20 years. Utility loads, as generally defined in plumbing, mechanical, and electrical codes, are the sum required capacity of all components in a building connected to a utility system. Demand is always less than the load. For example, the electrical load for a building accounts for every electrical outlet installed. Demand accounts for only those in use at any one time.

5.4.1 Central Heating and Cooling

5.4.1.1 Buildings 11 and 34

When a large site has sufficient building density of buildings on site, central heating and cooling is more economical, energy efficient, and service reliable than utilities supplied by outside entities. For these reasons, many large government installations and university campuses use central heating and cooling. Examples around the area include the Federal Triangle, the Navy Yard, the University of Maryland, and George Mason University. Heating and cooling of NIH campus buildings is done through a central heating and cooling system. Steam is generated in Building 11, and chilled water is processed in Buildings 11 and 34, and distributed to buildings around the campus by a pipe network located in tunnels or by direct burial.

Building 11 has a floor footprint of about 76,000 sf and a total building gross area of 232,400 sf. Five boilers that supply steam to the campus occupy the north side of the building. The height of the building on the boiler side is approximately 90 feet. Chillers, which generate chilled water, occupy the south half of the building at ground level. Each chiller has a set of two cooling towers located on the roof, which is about 30 feet above ground level on the south side of the building.

A Master Utility Plan (MUP) completed in 1992 indicated the need for a major modernization and expansion of the central heating and cooling plant (Master Utility Plan, Task 4.0, Volume 1, Ross, Murphy, Finkelstein, Inc., 1992). Planning for plant, and the steam and chilled water distribution systems, was reviewed and updated in 2000 (Master Utility Plan 2000- Update (UMUP), Mueller Associates II, Inc., et al., 2000).

The 1992 MUP recommended completion of plant modernization in three phases, and NIH has completed the first two. The major elements that have been completed are:

- Installation of Boiler 5.
- Overhaul of Boilers 1 to 4 with retrofit of equipment to reduce emissions.
- The raising of boiler stack height, and the consolidation of the stacks into a single unit.
- In conjunction with PEPCO, the installation of a cogeneration (COGEN) unit that supplies both

- steam and electric power. The unit also has a Heat Recovery Steam Generator (HRSG).
- Expansion of the plant on the south side to accommodate ten new chillers and their associated cooling towers. These new chillers replace the original 10 smaller units originally located in Building 11, increasing total plant capacity from 37,750 to 68,000 tons. The new chilled water system uses about 35 percent less energy to generate a ton of refrigeration.
- Installation of a noise attenuation screen to reduce noise from cooling towers on the roof of Building 11.
- Installation of new energy saving equipment and controls that have advanced since 1992.
- Replacement or overhaul of supporting mechanical and electrical equipment to increase plant reliability.

The chiller and boiler plants operate throughout the year. They not only cool and heat buildings but also supply chilled water and steam for process use. Examples of process steam use include building humidity control, laboratory bench supply, animal cage cleaning, and sterilization of laboratory and hospital equipment.

Under certain circumstances steam and chilled water may be supplied to an individual building at different times throughout the day or to separate areas within a building at the same time to meet heating, cooling, and humidification requirements. Steam is also supplied to laboratory benches in research spaces. NIH and AAALAC standards for rooms holding individual animal species range from 61° F to 84° F. These individual space or room temperatures must be maintained within a tolerance of +/- 1.8° F. Heating and cooling of animal spaces within a building may be required if the outdoor temperature is intermediate between the extremes required for individual species. Temperatures in laboratories containing biological materials must also be maintained at lesser but close tolerances, and animal spaces and laboratories have relatively small tolerances for humidity levels.

NIH, therefore, requires a very high service reliability for steam and chilled water production, even when outdoor temperatures range to record levels, and as a result, there are two applicable definitions for boiler and chilled water plant capacities. The first is production plant capacity, which is the sum of all equipment nominal, or nameplate capacities. Capacity is also defined in terms of "firm" plant capacity. Firm plant capacity is the plant production capacity less the capacity of the largest generating boiler or chiller unit and interrelated support equipment. Firm capacity indicates that one boiler or chiller may be out of service for maintenance or repairs at any given time including periods of peak demand.

5.4.1.2 Steam

Data for existing steam demands, and those projected for the No Action and Master Plan Alternatives are shown in Table 5-17 for various operating conditions. The data for existing conditions are derived from plant steam production records for 2003.

Steam demand at NIH Bethesda has two primary components: steam used to heat buildings, and "process" steam that is used for all other purposes such as cleaning animal facilities, sterilization of research and medical equipment, building humidity control, and at the laboratory bench. Steam demands vary daily and by season. Heating steam demand fluctuates with outdoor temperature. Analysis indicates that on the average during the heating season, NIH needs an additional 6,300 lb/hr of steam for each Fahrenheit degree drop in temperature.

The annual average steam generated in 2003 by existing Boilers 1 through 5 was 217,750 lb/hr (1.907 billion pounds per year). The COGEN unit was operated periodically during this time as part of an acceptance testing program. It is estimated that the annual average steam production was 225,330 lb/hr with the COGEN operations included.

OPERATION CONDITION		2003 EXISTING CONDITON (lb/hr)	NO ACTION ALTERNATIVE (lb/hr)	2020+ MASTER PLAN (lb/hr)
Estimated Potential Peak Steam Demand at 0°F Min. Temp		585,000	776,000	968,000
Average Steam 20 Coldest Days		403,000	535,000	668,000
Winter Average (Dec-Feb)		340,000	451,000	563,000
Spring/Fall Average (Mar-May, Sep-Nov)		190,000	252,000	314,000
Summer Average (Jun-Aug)		155,000	206,000	256,000
Annual Average		217,750	---	---
Annual Average (with COGEN)		225,330	299,000	373,000

YEAR	ESTIMATED PEAK DEMAND OF 0° F MINIMUM TEMP. (lb/hr)	PLANT CAPACITY		REMARKS
		TOTAL (lb/hr)	FIRM (lb/hr)	
2003	585,000	800,000	600,000	COGEN in service. First Phase. Boiler 7 in service. Second Phase. Third Phase. Last Phase.
2005	774,000	980,000	780,000	
2009	738,000	980,000	780,000	
2011	773,000	1,180,000	980,000	
2015	878,000	1,180,000	980,000	
2020	913,000	1,180,000	980,000	
2020+	968,000	1,180,000	980,000	

TABLE 5-17 EXISTING AND PROTECTED STEAM GENERATION.

Seasonal variation is shown for the months indicated in Table 5-17. Production is concentrated in the winter months, so that production is less than the annual average for more than nine months of the year. The summer average, 155,000 lbs/hr, is indicative of the process steam demand, i.e. no heating requirement.

Demand has increased as the campus has developed. An all-time peak demand of 532,000 lb/hr was recorded on January 27, 2003. The overall average generation for this day was 475,000 lb/hr. Peak demands of 521,000 and 511,000 lb/hr were recorded on January 28 and 30, respectively. The average amount of steam produced on the 20 coldest days was 403,000 lbs/hr. January, February, and December 2003 were slightly colder, average temperature 34.63° F, than the normal of record 37.48° F.

Plant capacity must meet anticipated peak steam demands. The potential existing peak demand for planning purposes is estimated to be 585,000 lbs/hr. This corresponds to a daily minimum temperature of 0°F and an average daily temperature of about 8° F.

Campus steam demands do not increase steadily. They increase or decrease in steps as new buildings are brought on line, or existing buildings are demolished or taken out of service for renovation. Short term demand peaks occur when a new replacement building and its associated building to be demolished are on

line at the same time. Projections of future steam demands were based on factors for potential peak demand developed in the Master Utility Plan and its 2000 Update. These are 0.12963 lb/hr of steam per gross square foot (gsf) for laboratory research and animal holding spaces, and 0.1285 lb/hr per gsf for office, child care, and other non-research space. In a few cases, information was available and used for individual buildings. The factors were applied to the projected square footage of each type and accumulated into totals for the campus as a whole. Seasonal demands were determined by multiplying the 2003 demand by the ratio of the resultant future potential peak to the 2003 potential peak demand.

The Gateway Visitor Center, Commercial Vehicle Inspection Facility, and the Children's Inn Addition are relatively small and on the periphery of the campus. Each will be heated by independent building systems rather than connected to the central plant, and are not included in projected central plant demands.

The No Action Alternative steam demand projections are based on implementation of the "committed" projections shown in Table 4-3. The Master Plan Alternative projections assume full buildout or implementation of Master Plan projects, and demand will increase by an estimated 65 percent under these conditions.

Steam demands will increase sharply in the next two years when new buildings, now under construction, are occupied. The potential peak steam demand will increase to an estimated 774,000 lb/hr when the Hatfield Clinical Research Center, the Neuroscience Research Center, Phase I, and Building 33 are on line. Subsequently, the demands would decrease when Building 36 is demolished for NRC, Phase II, and portions of the Clinical Center Complex in Building 10 are taken out of service for renovation .

Building 11 houses five boilers and auxiliary equipment for generating steam and recovery of spent condensate. Boilers 1 through 4 each have a nominal capacity of 150,000 pounds per hour (PPH) of saturated steam. Boiler 5 has a nominal capacity of 200,000 PPH. Total plant capacity is 800,000 PPH and firm capacity is 600,000 PPH with Boiler 5 out of service. Boilers 1, 2, and 3 were installed in 1952. Boilers 4 and 5 went into service in 1969 and 1997, respectively. All the units supply steam at 165 psig.

Boilers 1 through 4 were overhauled between 1995 and 1997 as part of the central plant infrastructure modernization program. Earlier renovations included general refurbishment, installation of dual No. 2 fuel oil and natural gas feed, new state-of-the-art low nitrogen oxides (NOx) emission burners, and flue gas recirculation (FGR) for greater operating efficiency. Boiler 5 was installed incorporating the new features.

The central heating plant was in transition during 2003 with the completion of installation of a PEPCO/NIH Cogeneration (COGEN) facility. A COGEN facility generates both electric power and steam. The COGEN facility is located in the northwest corner of Building 11. Performance and acceptance testing was underway in 2003, and the facility contributed to the annual steam generation in this way. Full service operations are expected to begin in 2004. Additional information on the COGEN unit is given in Section 5.4.2.

Boiler 6 would serve as a heat recovery steam generator downstream from the turbine. Hot exhaust gases from the turbine would pass through the boiler to generate 108,000 PPH of steam. Supplemental dual oil/natural gas fired turbine exhaust duct burners in the boiler would permit generation of additional steam, increasing the overall COGEN facility capacity to 180,000 lb/hr.

As a condition of the contract between NIH and PEPCO, steam from Boiler 6 must be available to NIH for campus use for a minimum of 94 percent of the time each year. To meet this condition, PEPCO must provide alternative steam capacity, if it is necessary to meet the 94 percent availability requirement. This

would be accomplished by installing two or three temporary boilers on the west side of Building 11, and space must be available for them through the duration of the contract.

The virtually continuous availability of Boiler 6 will change central plant operational patterns. Boiler 6 will operate at 108,000 PPH virtually throughout the year and satisfy base campus loads and demands up to this level. Other boilers will be used only to supplement Boiler 6 as daily demands exceed its capacity. Boiler 6 is therefore a substitute for the remaining boilers, which would normally be rotated in service when demands are less than capacity. The application for a permit to construct the COGEN/Boiler 6 unit assumes that additional supplemental firing capacity in Boiler 6 would be 720 hours of operation per year. Operation times for supplemental firing will depend on the plant's day to day status in relation to permissible annual emission limits.

On the cooling side, Chillers 21 through 23 have been equipped with dual steam and electric power drives. Each has a 5,000 ton capacity. If they are steam driven, each requires 47,000 PPH of steam when operating at capacity, assuming 70 percent efficiency. The NIH boilers could be used to supply chiller steam during the warmer or summer months when campus demand is comparatively low.

Boilers 7 which would be needed for the Master Plan Alternative, but not for the No Action Alternative, is proposed as a 200,000 PPH capacity operating unit. It is estimated that Boiler 7 will be needed around 2011 or 2012. Boiler 7 would be located on the east side of the COGEN unit in an extension on the north side of Building 11.

5.4.1.3 Chilled Water

The 1992 Master Utility Plan (MUP) proposed a three phase program to completely modernize and expand the NIH Bethesda central refrigeration plants as follows:

- Phase I - Replace the original small Chillers 1 through 9 in Refrigeration Plant No. 1 in Building 11 with six larger high efficiency units, Chillers 16 through 21.
- Phase II - Increase plant capacity by constructing a building extension along the length at the south side of Building 11 for four additional Chillers, units 22 through 25.
- Phase III - Consolidate all facilities in Building 11 and provide for further expansion of capacity by construction of an extension on the east side of Building 11 for chillers beyond unit 25, as needed and decommission Refrigeration Plant No. 2 with Chillers 10 through 15 in Building 34, as circumstances permit.

NIH completed installation of Chillers 24 and 25 in early 2003 and building space has been provided for units 26 and 27. The plant now is composed of ten chillers, each with a 5,000 ton capacity in Building 11, and six chillers with unit capacities of 3,000 tons in Building 34. The overall total and firm plant capacities are 68,000 and 63,000 tons, respectively.

All of the chillers have electric drive. Chillers 21 through 23 have dual steam-electric drive with the steam supplied by NIH boilers. Auxiliary equipment is all electric and supportable by diesel generators under emergency conditions. NIH can provide 15,000 tons of cooling for critical demands completely independent of outside power sources.

NIH also has four 2,500 ton "free cooling" flat plate heat exchangers in Building 11 that can meet all or most of this demand. Free cooling takes advantage of cold outdoor winter temperatures. Condenser water is circulated between a cooling tower, where it is exposed to cold air, and the heat exchanger. The

chilled water returning from buildings bypasses the chiller compressors but passes through the heat exchanger. It is cooled by direct contact with the condenser water across the inner surfaces of the exchanger. The operation is thermodynamically efficient when outdoor temperatures are 38° F or less. Total nominal and firm free cooling capacities are 10,000 and 7,500 tons, respectively. The heat exchangers may be operated in parallel or series with chillers. When in parallel, they substitute as conventional chillers; when in series, they precool chilled water return increasing chiller efficiency. Since the exchangers are not available during the summer months, their capacity is not included in the plant total.

Each chiller in the central chilled water plant has an associated cooling tower located on the roof above. Each cooling tower for 5,000 ton chillers has two cells, which are 36 feet square. One side of each cell is an air intake side and must face outward. The cells may be arranged side by side, or one behind the other. In the latter case, the front to back dimension is increased to about 120 feet to ensure adequate fresh air flow to the rear unit.

The average annual chilled water demand is about 18,000 tons. In 2003, the average demand in July and August was 38,000. An all-time plant average daily peak demand of 51,112 tons was recorded on July 5, when the maximum average, and minimum daily temperatures were 94, 84, and 73° F, respectively (Table 5-18). The second highest daily average occurred on August 21, when demand for the day reached 50,061 tons.

The average winter demand, indicative of campus usage other than for cooling, was 7,700 tons in 2003. Future peak chilled water demands were estimated by using factors developed in the MUP and UMUP in a manner similar to that for steam. Hospital, animal, and research spaces would require chilled water at a 117 gross square feet (gsf)/ton rate, other types of space at a 382 gsf/ton rate. The former is based on 15 building air changes per hour. No reductions for energy conservation measures are included in either category for two reasons: to produce a conservatively high estimated demand, and to provide a reference for measuring future conservation.

The Children's Inn addition, Gateway Visitor Center, and the Commercial Vehicle Inspection facility would be cooled by individual building air conditioning systems, and not connected to the central plant.

Under the No Action Alternative average daily peak chilled water demand would increase to approximately 66,700 tons. An additional 5,000 ton chiller unit would be required.

PERIOD ENDING	PEAK CHILLED WATER DEMAND (tons)	PLANT CAPACITY	
		TOTAL (tons)	FIRM (tons)
2003 Existing	51,112	68,000	63,000
No Action Alternative	66,700	73,000	68,000
Master Plan Alternative			
First Phase	62,700	78,000	73,000
Second Phase	71,000	80,000	75,000
Third Phase	47,900	80,000	75,000
Final Phase	76,900	80,000	75,000

TABLE 5-18 PROJECTED MASTER PLAN CHILLED WATER DEMANDS AND PLANT CAPACITY.

Capacity for the Master Plan Alternative would be achieved by implementing Phase III of the MUP modernization and expansion program. Six additional 5,000 ton chillers, units 26 through 31 would be installed with the first two going into existing space in Building 11. Units 28 through 31 would be installed in an extension of Building 11 on its east side. The six 3,000 ton chillers in Building 34 would be retired, and Building 34 converted to a Campus Center with amenities for employees. It is estimated that this will occur during the Second Phase of the Master Plan.

Ultimately, the central chilled water plant would have 16 chillers with a total capacity of 80,000 tons and a firm capacity of 75,000 tons. Although the estimated peak demand for ultimate buildout of the Final

Phase of the Master Plan is slightly higher than this firm capacity, 76,500 tons, it is anticipated that an acceptable level of reliable service will be achieved through implementation of energy conservation measures, which have been ignored in estimating future chilled water demands.

Specific thermal storage facilities have not been included in the Master Plan 2003 Update due to the apparent space constraints in the vicinity of Building 11. Nevertheless, the concept is retained. Implementation on a smaller scale or in individual buildings may be feasible in the future.

Under the No Action Alternative, the peak demand would increase to an estimated 62,000 tons by 2007 due to implementation of “committed” building projects. Chillers through unit 27 would be installed, but only four Building 34 chillers would be retired.

5.4.1.4 Steam and Chilled Water Distribution

The Master Utility Plan and Master Plan Alternative propose the conceptual formation of utility corridors in which campus support utilities would be concentrated (Figure 5-13). These corridors would be developed under both the Master Plan and No Action Alternatives. In general, the corridors follow existing utility concentrations, but many collection and distribution lines other than individual building services crisscross development blocks. The concept formalizes long term planning for the transfer or relocation of these lines to the corridors. Utilities would be relocated to the corridors as Loop Road improvements are made, individual building sites are developed, or as the existing utility tunnel system is expanded.

The general concept for steam and chilled water is to create a grid of distribution and return lines along and inside the Loop Road. This would permit distribution and return by two paths to the point where individual building service drops connect to the grid, even those outside the Loop Road. Major steam and chilled water lines on the campus are located in tunnels, or concrete-encased utility trenches. Minor lines and most building services are buried directly. Lines in tunnels are accessible for direct inspection, maintenance, and repair. Utility trenches generally are only wide and deep enough to contain the distribution and return lines. Access is available at interspersed vaults or inspection points. The main existing tunnel runs north-south between Building 11 and the Clinical Center. This tunnel extends southward to service Building 14. The Master Utility Plan recommended an east-west header tunnel through the core of the campus. The first segment or phase of this east-west tunnel was constructed between Center Drive and the main tunnel in 1994, and extended to Convent Drive in 1997. A tunnel would also be constructed eastward from Building 11 to Center Drive and thence northward to connect to the east-west tunnel to form a distribution loop.

Steam and chilled water service for the South Quad and other facilities to the south of Building 11 would be provided in a utility trench prior to the construction of the Animal Research Center. Service to Buildings 31 and 33 in the northeast campus sector would also be accommodated through a utility trench loop system.

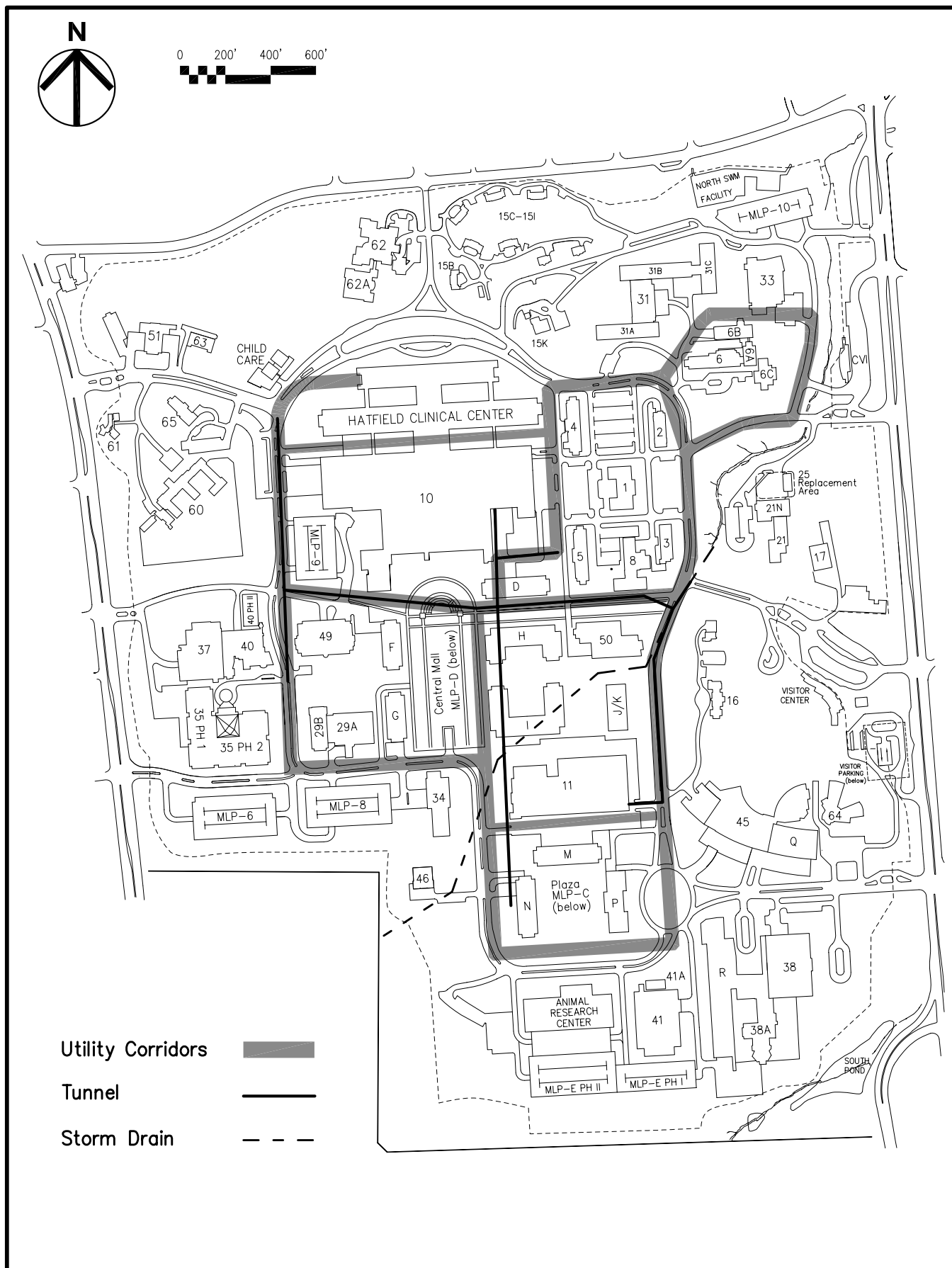


FIGURE 5-13 UTILITY CORRIDORS.

Other significant distribution system needs identified in the MUP 2000 Update include:

- Replacement of the steam main in the tunnel between Building 11 and Building 10/Clinical Research Center with one of sufficient size to handle projected demand increases.
- Metering of the steam and chilled water distribution systems to provide more detailed information on building demands and system operational characteristics. NIH installed water submeters in Building 11 to measure usage by the steam and chilled water generation systems. The monitored water does not go to the sanitary sewer system; it is released to the NIH Stream or campus storm drains, lost in system distribution, or evaporated to the atmosphere. The metering will permit deduction of these uses from the sewer component on WSSC water bills with concomitant savings on sewer charges.
- Modernization and expansion of the campus Supervisory Control and Data Acquisition (SCADA) system that monitors campus utility and alarm systems electronically. The existing SCADA system predates personal computer developments that have occurred over the last decade, and it does not cover all the utilities on the campus. The MUP Update further recommends that the SCADA command center be relocated to a dedicated secure space that would be manned on a 24 hour basis

Hydraulic analysis of the campus chilled water distribution system completed in the MUP Update indicates that it is critically important that the operating temperature differential between chilled water supply and return at the plant be increased from the current 10° F to 18° F as recommended in the original Master Utility Plan. This is essential if the existing distribution system is to be used to meet future increases in demand. The increase can be gradually achieved by installing new and retrofitting existing individual building air handling units capable of operating at the 18° F temperature differential.

5.4.2 Electric Power

Power is supplied to the campus by the Potomac Electric Power Company (PEPCO) via three PEPCO substations. PEPCO Substation 80 is located in Building 17 to the northwest of the Rockville Pike/South Drive intersection. Primary distribution to the substation is via four 35 kilovolt (KV) lines from Rockville Pike. PEPCO equipment in the substation includes one 30,000 kilovolt-amp (KVA) transformer, two 20,000 KVA transformers, one 10,000 KVA transformer, and related switchgear. PEPCO Substation 167 is located in Building 46 on the southwest side of the campus. It is served by three 35 KV lines, extending from Old Georgetown Road, that supply three 20,000 KVA transformers.

Construction of the third substation, NIH North substation in Building 63, was completed in 2002, and equipment installed in 2003. This substation is wholly owned and operated by NIH. The purpose of the station is to not only provide needed additional capacity, but also increase service reliability. The substation will have space for three 30,000 KVA, 35/13.8 KV transformers. Only two of the transformers will be installed initially. They will be dedicated to NIH service. The 60,000 KVA additional capacity will increase the total capacity of the three campus substations to 200,000 KVA, and the allocated NIH capacity to 169,000 KVA. The installation includes a new satellite switching station in Building 59. The substation is scheduled to go into service in 2005.

The total capacities of Substations 80 and 167 are 80,000 KVA and 60,000 KVA, respectively for a combined capacity of 140,000 KVA. Capacity is shared with customers other than NIH. Substation 80 supplies power to the Naval Medical Center and one non-government outgoing 15 KV feeder to the Bethesda area. Substation 167 supplies the Uniformed Services University of the Health Sciences and the Medical Center subway station as well as NIH. The capacities available to NIH, 70,000 KVA at

Substation 80 (Building 17) and 39,000 KVA at Substation 167 (Building 46), are set by a NIH-PEPCO service contract.

Buildings 17 and 46 are joint PEPCO-NIH use substations. PEPCO owns the buildings, the 20,000 KVA transformers and some related 15 KV switchgear. NIH owns and operates 15 KV main breakers, tie breakers, and feeder breakers that protect the internal campus 15 KV cable distribution system that feeds spot networks in different NIH buildings. Both substations have an interior wall that separates PEPCO switchgear and facilities from NIH switchgear and facilities. The interconnecting electric bus through the common wall belongs to PEPCO.

NIH identifies their facilities in Building 17 as the East NIH Substation, and those in Building 46 as the West NIH Substation. NIH has extended the East NIH Substation switchgear to a satellite station in Building 45 (NIH East Satellite Substation) via a cable extension from the East NIH Substation switchgear bus.

The East and West NIH substations in Buildings 17 and 46 are fed by PEPCO Substation 121 via PEPCO Substation 6, although one feeder to Building 46 is routed directly from Substation 121. The Substation 121 itself is fed by three independent power sources interconnected to four distribution busses, and it is considered to have a high operational reliability. However, the existing lines between the station and NIH through Bethesda are overhead and subject to potential storm damage. The North Substation is fed underground directly from Substation 121 by a route totally separate from existing routes providing redundancy.

PEPCO Energy Services Inc. and NIH have signed a contract for installation of a electric power cogeneration (COGEN) unit in Building 11. The COGEN unit is composed of a turbine, boiler, and auxiliary support equipment. The natural gas fired turbine has a nominal capacity of 23 MW (23,000 KW), and will generate about 19.6 MW of electric power, when operational efficiency is accounted for. The hot exhaust gases from the turbine will pass through Boiler 6 to recover heat prior to release in the plant stack. The heat recovered will generate 108,000 PPH of steam. The turbine and boiler will operate in an on-off mode. Supplemental direct firing of Boiler 6 will provide a capability to produce an additional 72,000 PPH of steam.

PEPCO Energy Service, Inc. will finance and build the COGEN unit, and operate it for ten years. NIH will purchase the electricity produced during this period. Power produced will be sent via 15 KV underground cable to the West NIH Substation in Building 46. NIH payments for the electricity produced will be credited toward the purchase of the COGEN plant. The plant has been undergoing performance testing in 2003, and it is anticipated that it will be in service in 2004, and NIH takeover is projected to occur in 2014. Economic analysis completed for the project indicates that it will save NIH, when it owns the unit, about \$5.5 million annually in power cost.

Utility deregulation, and corporate actions are leading to a rapidly evolving electric power environment. PEPCO received approval of its merger with Conectiv in September 2001. PEPCO has expressed its intent to concentrate on power distribution and sell all its generation plants. PEPCO and Conectiv are members of the PJM wholesale electric power market in the Mid-Atlantic region. Power generation and distribution are shared across the PJM area, which covers New Jersey, Pennsylvania, Delaware, and Maryland. With deregulation, PEPCO/Connective will still deliver power to NIH Bethesda, but it may be purchased elsewhere. The PJM market area appears to have sufficient reserve capacity for the next 10 to 15 years. However, experience with deregulation in Pennsylvania within the market indicates that greater volatility in short term prices can be expected. The NIH COGEN plant will provide NIH with opportunities and flexibility in a deregulated power market.

The East NIH Substation serves 43 buildings in a service area north of South Drive and east of Service Drive West. At the East NIH Substation, all PEPCO and NIH switchgear was replaced in 1991 with new 750 MVA rated vacuum breakers. The West NIH Substation covers 12 buildings in the southwest sector of the campus. Both substations provide power to the Magnuson Clinical Center Complex. In some cases, power is fed to clusters of buildings via satellite switching substations. The East NIH Substation supplies the power plant, Building 11. Three transformers in Building 11 convert 13.8 KV to 2.4 KV for large motor loads. Other transformers convert 13.8 KV to 480Y/277 volt or 208Y/120 volt to operate auxiliary and pumping equipment and for house current. Building 34, the Auxiliary Chiller Plant, is served from the West NIH Substation. A few small buildings around the campus receive power directly from the PEPCO system, rather than through the campus substations.

All internal campus distribution lines and electrical equipment are owned by NIH and operated by its personnel. Primary distribution is made at 13.8 KV direct to all campus buildings, where it is converted to the building utilization voltage, which may be either 277Y/480 or 120Y/208 volts, three phase, four wire systems. This primary campus distribution system, consisting of 21 miles of 13.8 KV cables, 150 manholes and interconnecting underground duct, and six electrical equipment vaults, is judged to be in good to excellent condition.

NIH is subject to load curtailments during periods of high regional electric power usage. For example, NIH experienced three curtailments in the summer of 1999. In return for reducing campus loads temporarily on request from PEPCO, NIH receives a discount on purchase costs.

NIH Bethesda power usage is shown in Table 5-19. Data is based on PEPCO billings for power delivered to the NIH East and West substations combined. Four other accounts, including those for Buildings 60 and 62, are metered separately. The combined annual usage of the separately metered lines is about 2.65 million KWHR per year.

NIH demand increases in the summer due to power requirements to drive the chillers in the Central Refrigeration Plant (0.86 KW/ton). Chilled water generation accounts for 50 to 60 percent of the total campus demand when the outdoor temperature is 90° F or above. Overall campus electric power demands increased steadily by 32 percent between 1992 and 2003.

Maximum demand for each month is recorded on PEPCO billings. The campuswide recorded maximum demand was about 74,500 kilowatts (KW) in June 2002. The annual maximum power demand generally corresponds with maximum or peak chilled water production. While there are wide diurnal fluctuations in demands, it is estimated that building demands are relatively consistent from work day to work day. The estimated peak or maximum demand for all facilities on the campus other than the chilled water plant is roughly estimated to be about 32,000 KW.

Comparison of 2002 and 2003 billing dated for maximum or peak usage shows the effects of the COGEN unit. The unit was operated periodically in 2003 while undergoing performance acceptance testing. It generates about 19,600 KW of power on a continuous basis, when operating. Although undifferentiated, the KW HRS produced by the unit are included in the billing totals for Building 17 and 46. The billed maximum KW demand for 2003, however, includes only the peak demand on the outside PEPCO system serving the campus substations.

Projected Master Plan Alternative maximum electric power demands are shown in Table 5-20. Master Plan Alternative demands are projected to increase to about 132,000 KVA if all Master Plan Alternative projects are implemented. About half of the projected growth in demand will occur over the next two years as the Hatfield CRC, NRC Phase I, and Building 33 come on line. Projected demands are based on peak power demand needed by the chilled water plant. The projected higher power demand increase in

Month	2003 Power Demand Buildings 17 & 46 KWHR	2003 Power Demand Other Sources KWHR	2002 Maximum Demand ⁽¹⁾ KW	2003 Maximum Demand ⁽¹⁾ KW
January	32,000,000	218,000	56,036	51,786
February	29,996,000	192,000	54,339	39,483
March	31,164,000	220,000	55,215	44,112
April	28,948,000	214,000	64,099	43,766
May	33,213,000	224,000	64,283	43,405
June	34,275,000	239,000	74,486	54,540
July	38,944,000	240,000	72,663	49,525
August	40,570,000	245,000	71,201	50,477
September	40,978,000	195,000	70,977	53,261
October	31,328,000	212,000	52,038	36,433
November	34,840,000	216,000	48,971	36,929
December	32,886,000	230,000	50,966	37,916
Total	409,144,000	2,645,000		

	Annual Usage (KWH)	Maximum Demand (KW)
1992	305,800,000	53,350 (July)
1996	311,200,000	63,424 (July)
1998	342,800,000	69,608 (May)
2000	358,800,000	67,613 (August)
2002	402,800,000	74,486 (June)
2003	411,800,000	74,000 est. (June)

Notes: (1) For Building 17 and 46 combined.
Source: PEPCO billings.

TABLE 5-19 NIH ELECTRIC POWER USAGE.

relation to building space increase is created by higher unit demands. Most of the Master Plan growth proposed will be research and animal space which use significant more power in terms of watts per square foot than office or general space (7 w/gsf vs. 4 w/gsf). Indirectly, the disparity is even greater. Laboratories and animal space require 7.53 w/gsf to produce the necessary chilled water under peak demand conditions. Offices and general spaces similarly require only 2.25 w/gsf for air conditioning. The projected demand estimates include multiple level parking structure lighting at 2 w/gsf. General site or outdoor lighting is included in the 2003 billings, and it is assumed that it will remain constant in the future.

Under the No Action Alternative, maximum electric power demands are projected to increase to about 107,000 KVA.

<u>Year</u>		<u>Maximum Demand (KVA)</u>	
2003		78,400	
2005		106,500	
2009 End First Phase		105,000	
2015 End Second Phase		121,200	
2020 End Third Phase		124,500	
2020+ End Final Phase		131,800	
<u>Substation</u>	<u>NIH Demand KVA)</u>	<u>NIH Capacity KVA)</u>	<u>Total Capacity (KVA)</u>
East (Bldg. 17)	51,000	70,000	80,000
West (Bldg. 46)	30,000	39,000	60,000
North (Bldg. 63)	<u>50,800</u>	<u>60,000*</u>	<u>60,000*</u>
Total	131,800	169,000	200,000
* Space provided for 90,000 KVA.			

TABLE 5-20 PROJECTED MASTER PLAN MAXIMUM ELECTRIC POWER DEMANDS AND SUBSTATION CAPACITY.

Chillers 21 through 23 will have dual steam/electric drive. They will have a combined capacity of 15,000 tons. Switching to steam drive during the summer months when demand is highest eliminates 0.6 KW/ton of chiller demand. Some electric power is needed to run the cooling towers, but the net reduction when producing 15,000 tons of chilled water would be about 8,850 KW or 9,300 KVA.

NIH began a cable replacement program for its primary 13.8 KV (15 KV) cable campus distribution system in 1992. Approximately half of the cable has been replaced. With completion of the North Substation, NIH will begin a program to redistribute campus electrical loads among the three substations. The distribution system will be converted to a loop network so that critical or important loads can be met, even if power is lost at one of the substation. The distribution of demand among the substations under Master Plan buildout condition is shown in Table 5-20.

Campus power distribution will change with the connection of the North Substation to the campus network. The electrical load will be redistributed among Buildings 17, 46, and 63. The number of satellite switching substations will be increased to seven to provide greater system reliability and flexibility.

5.4.2.1 Emergency Electric Power

Emergency power is defined as backup electric power that is needed quickly when the normal means of supply is interrupted or lost. Emergency power requirements are divided into two general levels.

Level 1 service requires replacement of electric power with an alternate source within ten seconds of loss. It is divided into two categories: life support and critical. Examples of demands within Level 1 service include fire alarms, firewater pumps, emergency lighting, hospital patient care and support such as life support equipment, surgery room power and lighting, intensive care spaces, and critical laboratory equipment. Alternate source power at Level 2 service can be replaced within intervals greater than ten

Year	Total Load (KW)	Space Type	Rate (w/gsf)
2003	16,005	Clinical Research	10
End First Phase	20,300	Animal Care	7
End Second Phase	24,400	Laboratory	6
End Third Phase	26,400	Building 13/Service	5
End Final Phase	29,600	Office	4
		Existing Building 10	2
		Other	0.5

TABLE 5-21 PROJECTED MASTER PLAN EMERGENCY POWER REQUIREMENTS.

seconds. Examples include heating, ventilation, and restart of refrigerators or freezers holding temperature sensitive biomaterial or stored MPW awaiting pickup and disposal.

Currently, there are 48 emergency diesel generator units on the campus ranging from 60 KW to 1,825 KW in size. Seven units are 700 KW or larger. Total nominal capacity is 16,005 KW. Analysis completed in the 1992 Master Utility Plan indicated that about two-thirds of the emergency power load was Level 1 service.

Three 1,500 KW units were installed recently in a "central" emergency generator plant in Building 59A replacing two smaller units in Building 11. They supply power to Building 10, and the central steam and chilled water plants in Building 11. Five additional generators at Building 10 with a combined capacity of 2,635 KW supplement the Building 59A facility and serve individual functions within Buildings 10 and 10A. Emergency power generators at the Building 14/28 animal care complex support the entire building demand (2,005 KW or about seven watts per gross square foot (w/gsf)).

In older buildings on the campus, backup or emergency power is generally limited to critical loads. Emergency power at Buildings 31 and 38 support only emergency lighting (0.25 w/gsf). Supported loads or demands in older laboratories varies considerably from building to building, but averages about four watts per gross square foot.

Recently developed emergency power design criteria for hospital and research space account for increased loads per unit of space. Demands have increased with increased use of electronic equipment and personal computers. Industry trends indicate these demands will grow further over the next decade. Recent construction at NIH reflects this trend. Backup or emergency power is supplied for greater portions of or the entire building load or demand. Building 45, an office building, has a 1,000 KW generator capable of supplying emergency power at four w/gsf. Laboratory Building 49 and 50 are serviced at six w/gsf, and Building 40 will be serviced at 5.5 w/gsf when Phase II is built.

Projected campus emergency power requirements for the Master Plan Alternative are shown in Table 5-21, assuming the implementation schedule shown in Table 4-2. The No Action Alternative requirements would rise to about 21,000 KW in 2007 and remain at that level.

The loads shown in Table 5-21 are net values accounting for new buildings and demolition. Service requirements for new buildings were determined by type of space at the rates shown in the table. Existing units servicing individual buildings were deducted, if the building is to be demolished. In practice, these units could be relocated. It was assumed that renovated Building 10 would be laboratory space.

5.4.3 Water

Water is supplied to NIH by the Washington Suburban Sanitary Commission (WSSC). The WSSC transmission and distribution grid surrounds NIH. WSSC maintains 12" and 24" diameter mains under Old Georgetown Road and a 24" main under West Cedar Lane. The water main along Rockville Pike is 12" in diameter between West Cedar Lane and South Drive, and 8" in diameter to the south. Service pressures in the area are established at the Alta Vista standpipe and tank located on the north side of West Cedar Lane about 300 feet to the east of Old Georgetown Road and across the street from NIH. The system head or pressure elevation is 495 feet. Area mains are fed by water from the WSSC Patuxent and Potomac Water Filtration Plants.

NIH receives water at seven metered locations around the campus:

- An 8"-line at Rockville Pike and Woodmont Avenue
- An 8"-line north of South Drive at Rockville Pike
- A 12"-line at West Cedar Lane and Crest Drive
- A 12"-line at West Cedar Lane and West Drive
- A 10"-line at West Cedar Lane and West Drive
- A 16"-line at Old Georgetown Road and South Drive
- A 10"-line via Roosevelt Street in Edgewood/Glenwood

Internally, a grid network of 10" water mains owned and operated by NIH serves the campus. The grid forms 14 separate squares or loops which surround individual clusters or blocks of buildings. An 8" main serves the southern periphery of the campus and a 6" diameter main services the residential area on the north side of the campus. Service lines to all buildings except the residences range from 4 to 8 inches in diameter.

Since 1995, NIH has cleaned and restored the campus distribution system, returning it to the original capacity. Building service lines have been upgraded or increased in size. And a new 16"-main through the center of the campus and 12"-main around the west and north sides of the new Clinical Research Center have been added to greatly enhance general service and provide adequate fire flows.

Based on WSSC meter readings at the seven water service entrances to the campus, the average water usage at NIH Bethesda in 2003 was approximately 2.141million gallons per day (MGD) (Table 5-22). In1993, the average daily use was 1.846 MGD. The relatively low increase in demand compared to campus growth over the intervening period is attributable to water efficient plumbing installed in new facilities such as Buildings 40 and 50 in the intervening period. Seasonally, average daily usage is higher in the summer months, when a large amount of makeup water for the chilled water system is needed. Typically, water usage during the peak month, generally July or August, averages about 3.0 MGD, while average low monthly use is about 1.5 MGD. The 3.03 MGD average demand in July 2003 was unusually high, and a record use for a given month.

Month	Vault #1 (Roosevelt)	Vault #2 (Old Georgetown)	Vault #3 (W. Cedar Lane- West)	Vault #4 (W. Cedar Lane- East)	Vault #5 (Rockville Pike- North)	Vault #6 Rockville Pike- South)	Vault #7 W. Cedar Lane	Total Campus Flow
JAN	150.7	331.4	129.5	46.6	20.6	0.0 ⁽³⁾	868.8	1547.7
FEB	148.3	376.5	127.2	153.4	6.3	0.0 ⁽³⁾	856.0	1667.7
MAR	150.8	369.3	126.5	154.1	18.2	0.0 ⁽³⁾	854.0	1672.9
APR	140.9	347.6	122.6	149.8	24.8	199.3	827.7	1812.6
MAY	140.4	349.7	118.3	152.0	21.2	268.8	842.6	1893.0
JUN	171.8	438.1	158.2	184.6	40.9	395.4	1089.1	2478.2
JUL	189.6	533.5	177.4	208.5	48.5	637.3	1230.1	3025.1
AUG	188.1	538.6	179.3	213.7	38.1	627.8	1225.6	3011.2
SEP	141.1	361.7	144.5	165.2	23.6	622.6	963.4	2422.0
OCT	126.8	353.9	124.9	151.8	15.7	803.7	881.0	2457.7
NOV	143.6	403.2	119.8	147.0	19.5	416.5	852.7	2102.3
DEC	141.0	322.0	107.8	141.3	11.9	76.9	802.7	1603.5
AVG	152.8	393.8	136.3	155.7	24.1	337.4	941.1	2141.2

Note:

1. Data taken from utility billings.

2. Average flow based on number of days in billing period. The length of billing period varies from meter to meter.

3. Out of service for all or portions of the month.

TABLE 5-22 NIH AVERAGE DAILY WATER CONSUMPTION IN 2003 SUMMARY (in thousands of gallons day).

The Master Plan Alternative average daily water usage on an annual basis is projected to increase as follows:

<u>Year</u>	<u>Average Daily Usage (MGD)</u>
2003	2.141
2005	4.629
End First Phase	4.924
End Second Phase	5.820
End Third Phase	5.994
End Final Phase	6.376

NIH water use can be divided into three categories, general domestic or building use, water needed for makeup of steam, and water used in the chilled water plant. Estimates of diurnal building water usage patterns can be inferred from a sanitary flow monitoring program conducted by ADS Environmental Services, Inc. from December 1992 to June 1993. Flows were monitored continuously at individual buildings as well as at NIH sanitary Manholes 4 and 23. They are the last two manholes in the campus sanitary system draining to West Cedar Lane. Daily averages, minimums, and maximums were recorded. Building water usage was estimated by correcting for NIH buildings that send sanitary flow elsewhere, and for non-NIH sanitary flows at Manholes 4 and 23 (See Section 5.4.4). Comparison of NIH monthly water bills with sanitary flows at the time of monitoring, and after correction for steam and chilled water use, indicate that the building sanitary flow is about 93.5 percent of the building water demand.

Water usage at NIH fluctuates during a given day. Analysis of the 1992 monitoring data indicates that NIH has two distinctive building water use patterns, one applicable to work week days between 7:00 AM to 5:00 PM, and the other for the remainder of the time. The average building water use during the non-work hours was about 750 gpm. The average daily minimum was 508 gpm, although daily minimums fall to as low as 150 gpm on occasion. Building water usage increased sharply between 7:00 AM and 5:00 PM on work days. The average building demand was about 1,750 gpm during this period. The average work day maximum flow was 1,942 gpm, although daily maximum flows exceeded 2,100 gpm several times a month. The estimated 2003 maximum building water demand is 2,197 gpm. This is equivalent to 0.00030 gpm/gsf.

Existing and projected Master Plan maximum water demands are shown in Table 5-23. Water demands for chilled water (0.0279 gpm/ton) and steam generation are superimposed on building demand. Chilled water production requires far more water per unit than steam. Maximum total water demands therefore occur during the summer months as reflected by the monthly billings.

Building water demands per unit of space will also increase. Laboratories and animal spaces use much greater amounts of water than offices and general use space (0.00054 gpm/gsf vs. 0.00024 gpm/gsf). Most of the new space proposed in the Master Plan Alternative is of the former type. The overall average building water usage factor per unit of space is projected to increase to 0.00037 gpm/gsf.

The Master Plan total maximum water demand, which includes central plant consumption, would increase to about 6,400 gpm. Under the No Action Alternative, total maximum water demands would increase to an estimated 5,100 gpm by 2007.

Fire flows at NIH are 1,250 gpm for buildings with an additional 500 gpm for site building density in accordance with the National Fire Protection Association Code.

Year	Direct Building Use	Chilled Water Makeup	Summer Steam Makeup	Total
2003	2,197	1,531	66	3,794
2005	2,781	1,769	79	4,629
End Of First Phase	3,003	1,838	83	4,924
End of Second Phase	3,596	2,125	99	5,820
End of Third Phase	3,709	2,182	103	5,994
End of Final Phase	3,968	2,299	109	6,376

TABLE 5-23 EXISTING AND PROJECTED MASTER PLAN MAXIMUM WATER DEMAND
(in gallons per minute).

In its review of the Draft EIS for the 1995 Master Plan, WSSC indicated that there was sufficient WSSC transmission and distribution capacity to meet NIH and surrounding community needs.

5.4.4 Sanitary Sewer

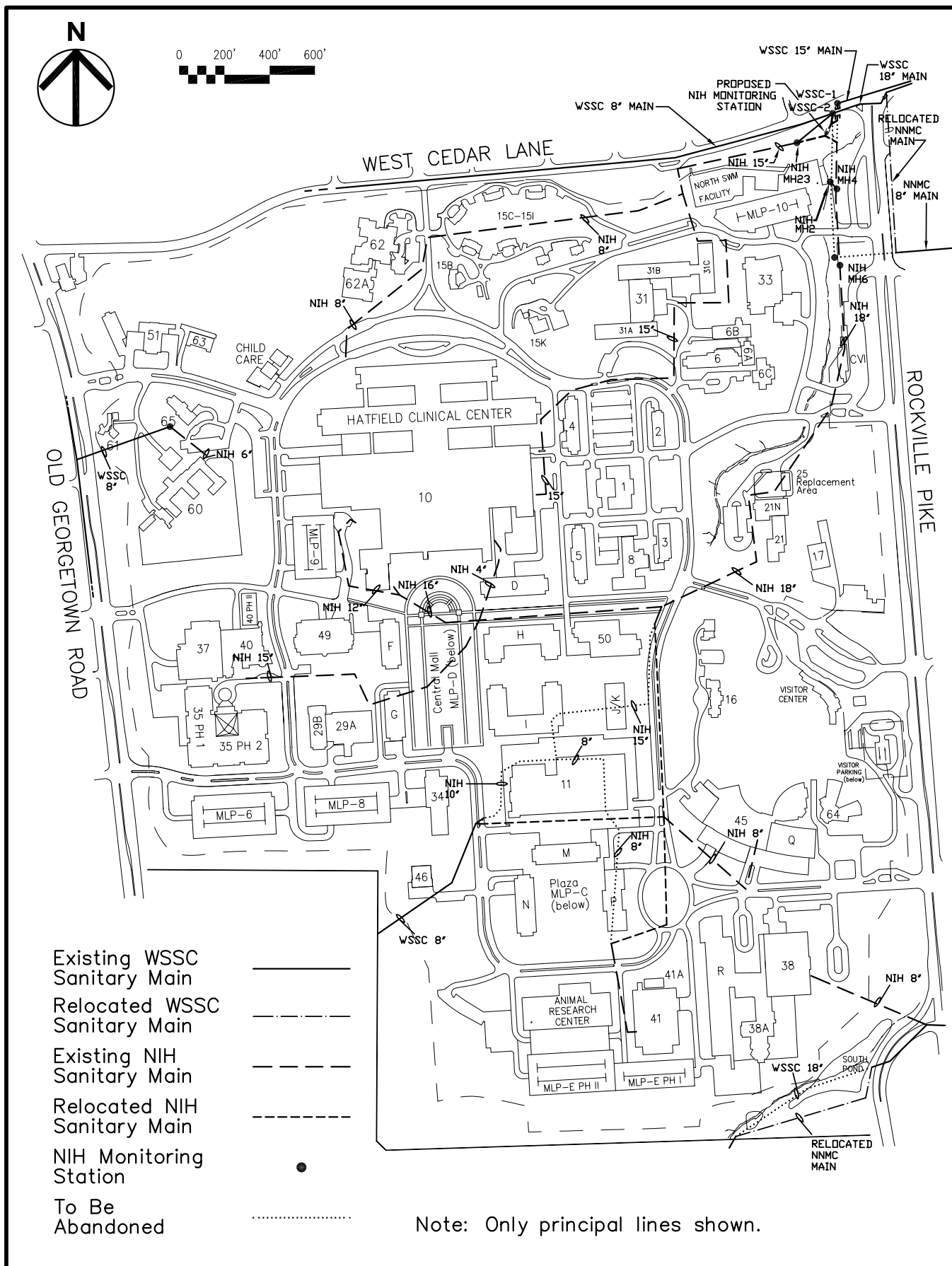
NIH is in the Washington Suburban Sanitary Commission (WSSC) sanitary sewer service area. WSSC maintains an 8 to 12-inch diameter sanitary main under Old Georgetown Road that ultimately connects to a collection system to the west of the campus. An 8-inch main runs under most of the length of West Cedar Lane on the north side of the campus. This line carries an estimated 80,000 gallons per day of sanitary waste from sources outside NIH, primarily the Maplewood residential neighborhood. There are no sanitary lines along Rockville Pike on the east side of the campus.

WSSC also operates and maintains short sections of sanitary mains within the NIH campus at four locations. The first of these is in the northeast corner of the campus where the main NIH sanitary system serving all but a few buildings connects to WSSC and NIH manholes 4 and 23 (Figure 5-14). WSSC maintains two short sections of main between the NIH manholes and WSSC lines under Cedar Lane. The WSSC system expands to two parallel mains, 15 and 18-inches in diameter downstream from the NIH outfall. These mains combine with one another on the east of Rockville Pike to form a main that follows the NIH Stream to a connection with the Rock Creek Trunk sewer.

The WSSC 15 and 18-inch lines are not interconnected. Flows from NIH are roughly equalized between the two WSSC mains by separate connections to each, and an interconnection between NIH manholes 2 and 4. Manhole 2 is located on a separate 8-inch main serving the National Naval Medical Center (NNMC).

The second WSSC main crosses the southeast corner of the campus following the Stony Creek valley. It is 18-inches in diameter as it crosses the campus, but increases to 21 inches in size at Woodmont Avenue. This main serves most of the Woodmont Triangle of the Bethesda CBD as well as residential areas to the southwest of Old Georgetown Road before entering the campus. It proceeds to the east after crossing Woodmont Avenue, collecting sanitary waste from the bulk of the NNMC as well as the Uniformed Services University of the Health Sciences and East Bethesda. The WSSC main paralleling Stony Creek follows that stream to Rock Creek about 0.5 mile to the east of the campus.

The third WSSC line on campus drains the Glenwood neighborhood to the southwest. It enters the campus at the east end of Roosevelt Street as an 8-inch main. The main connects to the NIH system near the southwest corner of Building 11. The last WSSC main on campus is a short section serving the Cloisters, Building 60, which connects to a WSSC Line under Old Georgetown Road.



The main NIH sanitary system can be divided, in general, into two separate collection networks that join one another in the northeast corner of the campus. The north network drains most of the old and new Clinical Centers and all the campus buildings north of Center Drive and the administrative area. The southern branch of this northern network is 15 inches in diameter between Building 10 and West Cedar Lane, and the northern branch primarily serves non-research type buildings (Building 15A-K, fire station and the Children's Inn).

The south network drains most of the remainder of the campus and divides into three principal branches. One serves the laboratories on the west side of the campus; the second follows the original course of the NIH Stream valley to Edgewood/Glenwood, while the third extends south to Building 41. An 8-inch sanitary main from the National Naval Medical Center joins the south network near East Drive. Buildings 38, 38A, and 46 are serviced separately by short, direct, and independent connections to surrounding WSSC mains that flow to the Stony Creek main. Buildings 1 through 9 are serviced by a small lateral system that connects to the southern network.

Sanitary flows were monitored continuously from December 1992 until June 4, 1993 at selected locations to provide checkpoint data for a hydraulic analysis of the NIH sanitary system (Utility System Analysis and Planning, Task 3.0, Volume II, Ross Murphy Finkelstein, Inc., 1994). Survey results provide information on daily flow patterns, and indirectly, water usage. Average monitored daily flows for the northern and southern networks combined were 1.425 MGD. However, NIH exhibits two distinct usage patterns, one applicable to the work weekday between 8 AM and 4 PM, the other applicable to all other times. Average daily weekday flows were 1.581 MGD, while on weekends the average was 1.077 MGD. From 8 AM to 4 PM, the average flow was 2.538 MGD. The peak dry weather flow was at a rate equivalent to 2,020 gallons per minute (gpm) (2.910 MGD).

Flows are generally equally divided between the north and south collection networks. The Building 10 outfall to the north network contributed about one third of the total flow at all times. Flows from the WSSC Glenwood main (0.049 MGD) and the NNMC (0.117 MGD) are included in the above averages. Sanitary wastes from both areas flow into the southern network. The NNMC volume is only a partial flow from that facility. It is estimated that the dry weather groundwater infiltration from six miles of campus sanitary lines is about 0.035 MGD. Infiltration from the Edgewood/Glenwood and NNMC systems is estimated to be double this volume.

Existing and projected maximum dry weather Master Plan Alternative sanitary flows are shown in Table 5-24. The large differences between maximum water demand and maximum sanitary flows are due to water evaporation in the central plant chilled water cooling towers. Cooling tower evaporation can account for 60 percent of total site water demand when temperatures are above 90°F. The tower makeup water is submetered and deducted from NIH sanitary sewer billings.

Peak campus sanitary flows will increase from 2,262 an estimated 2,380 gpm in 2003 to nearly 4,000 gpm by 2020 under the Master Plan Alternative. The portion to Cedar Lane would increase from 2,262 gpm to 3,784 gpm. When the contributions of Edgewood/Glenwood and NNMC are added to the NIH flows to Cedar Lane, it is estimated that the total maximum flow at the NIH Cedar Lane outfalls to WSSC will be over 4,000 gpm if the Master Plan Alternative is fully built out. Data in Table 5-24 is for the NIH Cedar Lane outfall. Using WSSC procedures, it is estimated that the residential community of Maplewood adds an additional 49 gpm to the WSSC main flow before it passes under Rockville Pike. Under the No Action Alternative, peak sanitary flows at the NIH Cedar Lane outfall would increase to an estimated 3,100 gpm.

The existing NIH sanitary collection system generally has adequate capacity to handle all development proposed in the Master Plan. A computer hydraulic analysis was made using existing peak flow

YEAR	NIH BUILDING SANITARY TO CEDAR LANE (A)	NIH BOILER ⁽¹⁾ TO CEDAR LANE (B)	NIH SANITARY TO OTHER WSSC MAINS (C) ⁽²⁾	TOTAL NIH SANITARY (D) = A+B+C	EDGEWOOD/ GLENWOOD TO CEDAR LANE (E)	NNMC TO CEDAR LANE (F)	TOTAL SANITARY TO CEDAR LANE G = (A+B+E+F)
2003	2,059	203	118	2,380	34	81	2,377
2005	2,600	243	118	2,961	34	81	2,958
2009	2,8072	256	118	3,181	34	81	3,178
2015	3,362	305	204	3,871	34	0	3,601
2020	3,467	317	204	3,988	34	0	3,818
2020+	3,710	336	246	4,292	34	0	4,081
(1) For boilers operating at peak winter demand.							
(2) Buildings 38, 60 and 64. Assumed to include the National Library of Medicine addition and Building Q in the future.							

TABLE 5-24 EXISTING AND PROJECTED DRY WEATHER MAXIMUM WEEKDAY SANITARY FLOWS (in gpm).

conditions which were 2.70 cfs for the north network and 3.94 cfs for the south network) conditions. Based on the analysis, the south network is operating at 22 to 33 percent capacity with the exception of the segment of the main stem north of Building 21, which operates at 45 percent capacity under peak flow conditions. The north network flows at 37 percent capacity or less, except for one section in Center Drive between NIH manholes 39 and 40 that is now at 84 percent capacity. The north network has an estimated capacity of 1,700 gpm, and the south network, a 3,900 gpm capacity.

The two WSSC mains under Cedar Lane have an estimated combined capacity sufficient to handle projected NIH and other off-site flows based on a minimum slope of 0.54% in the WSSC mains between NIH and the Rock Creek trunk sewer paralleling that stream. The estimated capacity of the WSSC main downstream from NIH is about 4,700 gpm.

Wastewater in the Rock Creek trunk sewer is ultimately routed to the Blue Plains Wastewater Treatment Plant operated by the D.C. Water and Sewer Authority. The Blue Plains plant treats approximately 350 million gallons of wastewater per day. Discharges from the plant to the Potomac River must meet the National Pollutant Discharge Elimination System (NPDES) permit requirements established by the U.S. EPA. Treatment removes 90 to 100 percent of specific contaminants. Approximately one billion gallons per day of wastewater are treated by jurisdictions in the Washington Metropolitan area and discharged to the Potomac River. The average flow of the Potomac River at Washington, D.C. is 6.97 billion gallons per day (6,970 MGD) (Water Resources Report, Maryland & Delaware, USGS, annual).

NIH wastewater discharges must meet the pollutant concentration limits established by WSSC Discharge Authorization Permit No. 05967 (Table 5-25). The limits are those for a standard industrial discharger modified to meet more stringent criteria for discharges to the Blue Plains Wastewater Treatment Plant. Sanitary effluent is sampled once every four days at the NIH sanitary system discharge points with results reported to WSSC semiannually as is applicable for all industrial discharges under the NPDES program.

The effluent sampling points monitor sanitary discharges from all campus sources such as Building 11 and 21, the Clinical Center, and all laboratories as well as normal human waste. Most laboratories have separate acid waste drains to holding tanks. These wastes are not sent to the sanitary system, but disposed of in containers through the hazwaste collection and treatment system (See Section 5.7.2.3).

The total toxic organic (TTO) permit limit is a cumulative one, i.e. the combined concentration of about 125 U.S. EPA designated priority chemicals cannot exceed 2.13 mg/l. Over the years, monitored concentration, have been consistently far below permit limits. In 1999, NIH implemented a toxic Organic Management Plan (TOMP) to further reduce releases of TTOs to the sanitary system. WSSC has exempted NIH from reporting TTO monitoring results unless monitored TTO concentrations exceed 1.07 mg/l, and it has not been necessary to do so since 1999.

As part of the campus utility infrastructure modernization program, NIH would construct a sanitary wastewater monitoring station in the northeast corner of the campus (See Figure 5-14). The station would be a small underground structure that would facilitate access for obtaining monitoring samples. Sanitary lines in the vicinity would be relocated to combine the north and south networks for monitoring. Departing campus flows would be split between the WSSC 15-inch and 18-inch mains under West Cedar Lane to separate NNMC contributions from the NIH monitored flow. The NNMC sewer main would be disconnected from the NIH system, and the line relocated within the Rockville Pike right-of-way to the WSSC main.

Pollutant	Daily Max (mg/l)	NIH Self-Monitoring Required
Cadmium (total)	0.07	yes, Blue Plains limit
Chromium (total)	7.0	yes
Copper (total)	1.9	yes, Blue Plains limit
Cyanide (total)	1.3	yes
Lead (total)	0.7	yes
Mercury (total)	(---)*	no
Nickel (total)	4.1	yes
Silver (total)	1.2	yes
Zinc (total)	4.2	yes
Total Toxic Organics	2.13	yes, but see text
Dissolved Solids	1,500	no
Suspended Solids	400	no
Total Solids	1,900	no
Biological Oxygen Demand	300	no
Fats, Oils, Grease	100	no
pH	6.0-10.0 units	yes
Chemical Oxygen Demand	500	no
Temperature	150EF	no
* WSSC monitors for presence.		

TABLE 5-25 WSSC DISCHARGE LIMITS FOR NIH SANITARY WASTEWATER.

5.4.5 Storm Drainage

With the exception of a 32 acre area in the southeast corner and a five acre area along Old Georgetown Road, all of NIH drains to the northeast toward the West Cedar Lane/Rockville Pike intersection (Figure 5-15). The drainage area upstream from this point is 455 acres including 57 acres in the Edgewood/Glenwood neighborhood to the southwest of the campus, 55 acres north of West Cedar Lane in Maplewood, and 25 acres east of NIH along Rockville Pike and on the Naval Medical Center property. (See Table 5-44 for estimated site drainage areas).

All storm drainage systems on the campus are owned and maintained by NIH. The main collection

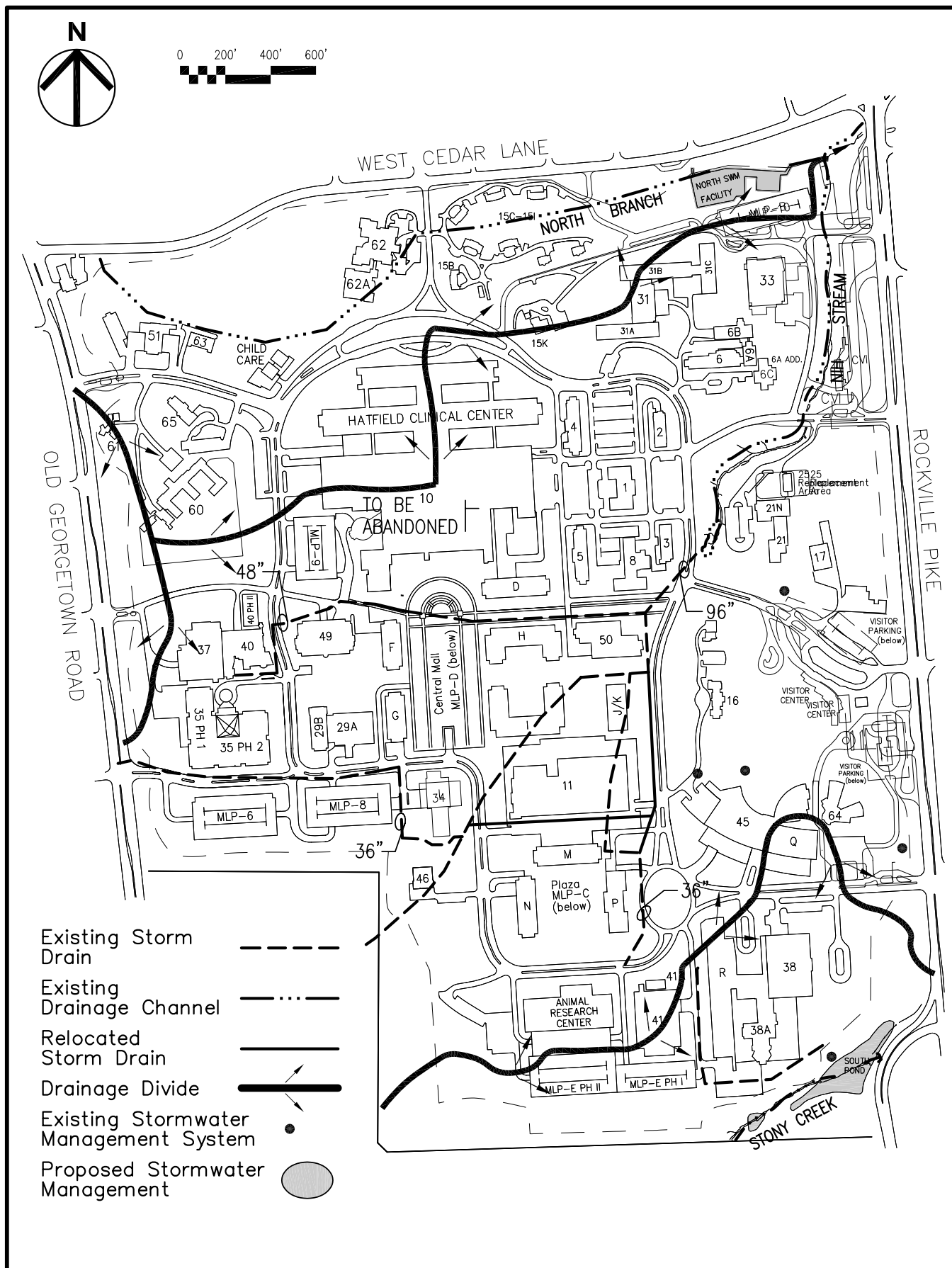


FIGURE 5-15 NIH STORMWATER DRAINAGE.

system has a trunk line interceptor that follows the original NIH Stream course. It enters the campus at the east end of Roosevelt Street after draining Edgewood/Glenwood as a 42" line and crosses the campus in a northeasterly direction, passing under existing Buildings 12B and 13, for a distance of approximately 2,350 feet. It progressively increases in diameter until it exits to daylight to the northeast of the South Drive/Center Drive intersection as a 96" pipe. It carries the flow of the NIH Stream during wet weather. Three other tributary drainage networks connect to the interceptor as it crosses the campus. A 12" to 36" line drains the southern area of the campus; an 18" to 36" line follows Lincoln Drive in the southwestern area; and a 12" to 48" line drains the laboratory area on the western side of the campus.

The second drainage area covers the northern sector of the campus. The dry channel of the North Branch of the NIH Stream is the main drainage stem for this area. Flows occur in the branch only during wet weather. The branch flows in a 48-inch diameter culvert under the residential area between West and Zerkova Drives. Elsewhere it is confined to a concrete-lined channel as it crosses the campus. Campus drainage occurs via overland flow, and through small individual collection networks serving building roofs and street and parking lot inlets. Stormwater drainage from West Cedar Lane and the western two-thirds of Maplewood also flows to the channel by direct pipe connections.

The third drainageshed is independent of the other two, covering the southeast corner of the campus. Most drainage is overland. A small storm drain network collects flows from the vicinity of Buildings 38, 38A, and MLP-7, and directs them to a small dry stormwater pond to the southeast of these structures.

In general, the campus storm drain systems are in good condition and adequately serve present conditions. In older areas of the campus developed prior to about 1965, drainage laterals from individual building downspouts and road inlets are often only 10 to 12 inches in diameter. This is sufficient to carry the 10- year design flows, but modern criteria are minimum 15-inch diameter pipes to prevent blockages and clogging, and facilitate cleanout. These lateral connections can be replaced as individual sites are developed and road improvements are implemented. Based on a hydraulic analysis of the campus networks all existing storm drains 15-inches and over in size have adequate capacity for expected Master Plan development flows.

5.4.5.1 Stormwater Management

Regulatory management of stormwater has been delegated by the U.S. EPA to local jurisdictions, in this case the Maryland Department of the Environment (MDE). Federal projects must follow the requirements of the Maryland Stormwater Management Guidelines for State and Federal Projects, MDE, July 2001, and State regulations given in COMAR 26.17.02.

Under the State guidelines, management of stormwater is accomplished in terms of quantity and quality control. Quantity control is achieved through detention of a computed channel protection stormwater runoff volume (CPv) as identified in the revised 2001 management guidelines. Similarly, quality management is obtained by applying a number of potential measures to treat a computed Water Quality volume (WQv). One management measure such as stormwater ponds can provide both quantity and quality control depending on design details. The computed volumes are not necessarily equal to the physical volume of the management facility, and combined may exceed it.

For Stormwater management purposes, pervious surfaces are those covered by natural vegetation; impervious surfaces are those covered by paving and buildings. For quality control, MDE has different requirements for "new" development and "redevelopment" sites that are already largely impervious. New development requires treatment of 100 percent of the computed MDE WQv. Under "redevelopment" the impervious project area must be reduced by 20 percent, or 20 percent of the MDE WQv must be treated, or an equivalent condition achieved by a combination of these measures.

The MDE guidelines give authority to the MDE Administrator to grant waivers for stormwater quantity, or channel protection, volume control to sites with an approved Institutional Stormwater Management Plan (ISMP), or projects that solely involve redevelopment of a site.

Management of stormwater at NIH Bethesda presents complex issues. Factors impacting potential management include four separate stream watersheds, storm drain and stream hydraulics, limited space available for potential stormwater management (SWM) facilities, and concentration of development in the NIH Stream watershed. NIH Bethesda is also different from normal residential and commercial development. It is dynamic with construction and demolition almost continuously underway, and this results in continually changing management requirements.

Discussions between NIH and MDE have concluded that NIH can meet the MDE SWM requirements through development and implementation of a NIH Bethesda Institutional Stormwater Management Plan (ISMP). NIH has prepared a Draft ISMP, which has been submitted, to MDE for review. The ISMP has been developed on stormwater management on a campuswide or "regional" basis. This offers several advantages. It significantly reduces the complexity of the factors involved. Sitewide facilities are more cost effective than smaller facilities serving individual buildings. Sitewide evaluation of impacts and management is more realistic. It permits increases in imperviousness in one area to be balanced or offset by decreases in imperviousness in another. The ISMP is applicable to the Master Plan and No Action Alternatives.

For the purpose of stormwater management in the ISMP, "existing" campus conditions are defined as those present just prior to the start of construction of the Hatfield Clinical Research Center. This baseline status was established at the design level for a proposed 1995 Master Plan Site SWM Facility that was included as an element in the Hatfield CRC project. The Hatfield SWM facility has been subsequently superseded by ISMP proposals. The "existing" campus impervious area is calculated as 129.2 acres, or 41.8 percent of the total campus (Table 5-26).

Future campus impervious surface area cannot be calculated with precision because the Master Plan is conceptual or schematic. Actual impervious cover will be dependent on the design layout of buildings, parking, roads, and sidewalks. Although the Master Plan would add over 3.3 million gsf of floor space under full buildout conditions, approximate computations indicate there would be little or no net change in site imperviousness. This occurs for two reasons. For the most part, existing one to three story facilities, such as Buildings 12, 13, and 14, will be replaced by five to seven story structures. Also, while parking will increase, more than 5,800 surface parking spaces will be consolidated into multilevel parking structures. It is estimated that the overall site imperviousness will be reduced to approximately 102 acres or 33 percent of the campus under full buildout Master Plan conditions.

Although the actual campus impervious area is projected to decrease under Master Plan and No Action Alternative development, the ISMP impervious area for computation of Stormwater management requirements will increase. This occurs because "redevelopment" of existing sites requires runoff quality control management and most of the projects listed in the Master Plan are presently occupied by buildings and parking lots. For example, Building 14 has a footprint extending over a little more than 10 acres. Redevelopment of the site with 10 acres of building and paving would result in no change in physical impervious area. However, the MDE requirement for a 20 percent reduction or treatment in Stormwater runoff in this case, computationally increases the ISMP has been based on a conservative increase of 43.0 acres accruing in this way to adequate management facility capacity.

Many types of structural facilities are available for stormwater management. They include water quality chambers, subsurface storage, surface ponds with permanent pools, dry basins, filtration, infiltration and

	North Branch	NIH Stream	Booze Creek	Stony Creek	NIH Total
Existing Site Areas by Drainage Basin	61.4	212.4	5.2	31.5	310.5
Baseline Buildings	4.5	39.0	0.1	4.0	47.6
Baseline Roadways/Parking	15.8	48.2	0.3	9.9	74.2
Baseline Sidewalks	<u>1.6</u>	<u>4.8</u>	<u>0.0</u>	<u>1.0</u>	<u>7.4</u>
Total Existing Baseline Impervious	21.9	92.0	0.4	14.9	129.2
Additional ISMP Build out Development	<u>9.0</u>	<u>27.0</u>	<u>2.0</u>	<u>5.0</u>	<u>43.0</u>
Total Ultimate ISMP Impervious	31.1*	118.6	2.4	19.5	171.7
*includes adjustment for post-CRC conditions.					

TABLE 5-26 NIH IMPERVIOUS SURFACE INVENTORY AND PROJECTED ULTIMATE CONDITIONS (in acres).

bioretention facilities, or any combination of these. Some facilities provide both quantity and quality control, others one or the other. If a facility does both, the computed quantity (CPv) and quality (WQv) volumes for a given facility may not be equal. The ISMP proposes management with two facilities: the North SWM facility, and the South Pond. The North SWM facility is a “Channel Protection” facility for quantity control; the South Pond would be a quality control facility. Each would be a campuswide facility and satisfy MDE requirements for the site.

Quantity Control

The recently constructed North SWM Facility replaces a pond proposed in the 1995 Master Plan for the northeast corner of the campus. It is located on the North Branch. The facility is composed of three underground or buried fields of large diameter pipe laid side by side in rows. Pipe lengths range from 50 to 100 feet. The fields are connected in series, and arranged so that each is filled in sequence. The facility is “bottomless” in that the pipes are perforated and laid on a stone base, so that stored water can percolate into the underlying subsurface. Release of stored water is controlled through a single, small diameter outlet pipe at each buried field. The facility is scheduled for service in 2004.

The required quantity control storage volume (CPv) criteria is 3.14 acre-feet, which is equivalent to that approved for the original pond by MDE in March 2000 (MDE No. 99-SF-0150). Under one year, 24 hour storm runoff conditions, the actual detained volume will be 3.30 acre-feet. The MDE channel protection objectives are achieved by extended detention that exceeds the minimum 24-hours required by the MDE guidelines. Design detention times range from 30 hours, when the soil is dry, to 56 hours when the soil is saturated. Under dry weather conditions, the facility has the potential for up to 1.57 acre-feet of groundwater recharge.

Quality Control

Determination of necessary Master Plan sitewide quality control volumes is complex. In agreement with MDE, an assumption is made in the ISMP to simplify calculations, ensure sufficient capacity for intermediate campus conditions and contingencies, and avoid uncertainties about details at the future project level. Although the impervious ground cover at NIH Bethesda is expected to remain relatively constant, in practice, it was assumed for the purposes of computing required SWM quality control volumes only, that 43 acres of the campus would be converted from pervious to impervious surface by Master Plan development. Although these 43 acres were apportioned among the campus drainagesheds,

they are not associated with any specific site locations or projects. All development in the Master Plan in impervious areas, as defined by pre-Hatfield CRC conditions, is considered as “redevelopment” for determining individual project SWM requirements. The assumptions produce very conservative estimates of quality control requirements.

MDE has indicated that their quality control requirements would be met by treating 20 percent of the site Water Quality Volume (WQv). In addition, NIH proposes treatment of 100 percent of the WQv generated by the hypothetical 43 acre increase in impervious area. The computed or estimated WQv for the 43 acres is 3.4 acre-feet, and for redevelopment, 2.2 acre-feet. The required total campus wide WQv is 5.6 acre-feet.

NIH quality control requirements would be met by the South Pond. Most of the Bethesda CBD and resident areas south of NIH were developed prior to enactment of sediment control and stormwater management (SWM) regulations. There are few potential locations for retroactive installation of management facilities within the CBD. Stony Creek, which courses through the southeast corner of the NIH campus after emerging from the upstream storm runoff collection system, drains this area. The 1995 Master Plan and EIS identified the area where it flows through the campus as a potential storm water management facility site, although a number of issues would have to be resolved before implementation.

The Montgomery County Department of Environmental Protection (MCDEP) has conducted a study of the Stony Creek watershed to assess conditions and make recommendations for returning Stony Creek flows to predevelopment conditions (Regional SWM Facility, Continuation of SWM Study for NNMC, A. Morton Thomas and Associates, Inc., 1998). The study determined that existing management facilities upstream in the Woodmont Triangle, and downstream on NNMC, were in good condition, but they provided only partial quantity control. Downstream facilities on NNMC could provide suitable quality control. The most beneficial SWM best management practice for the watershed would be a regional facility in the southeast corner of the campus.

NIH and the County have signed a Memorandum of Understanding (MOU) wherein NIH will grant an easement for the project, provided that certain conditions are met and issues are satisfactorily resolved. MCDEP will complete concept and preliminary designs to a level that would give better definition to proposed facilities, conditions, and issues.

Construction of a SWM facility at the site would involve the relocation of electric power, natural gas, and a WSSC sanitary sewer line. Under the provisions of the MOU, the County would be responsible for all construction cost and coordination including resolution of utility issues. NIH would review landscaping and public safety features. Monitoring and maintenance of the facility once it is built would be the responsibility of the County. Response to emergencies such as upstream pollutant spills would be handled jointly by the County and NIH through procedures to be given further definition as the project progresses.

The County Stormwater Management Facility, or South Pond, will have four elements (See Figure 5-15 and Figure 5-26). The first is an underground screening facility to trap trash and sediments. Access would be provided through the roof for clean out and maintenance. Runoff would then flow into a small forebay water pool, about 60 feet in diameter, where settlement of suspended material would occur. Outfall from the forebay pool would then flow into the main pool, which would be one acre in extent under dry weather conditions. A second trash collection facility would be located at the Woodmont Avenue outfall. The South Pond is scheduled for construction in 2005.

The pools would have water depths up to 5 or 6 feet in the center. The main pool would have a 12-foot wide “bench” around the perimeter, where water depths would be less than a foot, for planting

hydrophilic species. Montgomery County requires fencing around all wet ponds greater than two feet in depth.

The total drainage area upstream from Woodmont Avenue is 219 acres. For County purposes, the facility will serve as a quantity control facility. For example, it will reduce the one-year recurrence interval storm peak outflows through the twin 66-inch culverts under Woodmont Avenue from 219.5 cfs to an estimated 45 cfs (NIH South Pond Preliminary Design, A. Morton Thomas Assoc., 2002), and provide a channel protection storage volume of 5.52 acre-feet. The Pond will be capable of storing a six month storm, and quantitative management for 68 percent of the flow in a one year storm.

The facility will also provide 4.61 acre-feet of WQv storage for NIH. The wet pool of the main pond will contain 2.98 acre-feet of WQv at a water surface elevation of 300 feet. The remaining 1.63 acre-feet of water quality storage is achieved by Extended Detention of the one year storm runoff between the 300.0 and 301.5 pool elevations.

Restoration of the NIH Stream to its “natural condition” along the full length of exposure in the northeast sector of the campus is underway. Work includes bank stabilization, placement of rocks and riprap in a natural way, creation of micropools, and planting of native species within and alongside the stream. Flow velocity attenuators will be installed on storm drains outfalling directly to the stream.

The NIH Stream restoration project will also include the installation of six stormwater runoff quality treatment or storage facilities at strategic locations around the campus. Either bioretention or sand filter facilities will be installed. The estimated MDE WQv for these facilities combined is 0.96 acre-feet. This WQv is not included in the campus stormwater management total.

The MDE encourages non-structural Best Management Practices (BMP) for stormwater management. Additional CPv and WQv credits can be gained through their adoption. Examples of non-structural BMPs include disconnection of roof top drainage, open channels or swales with natural vegetation, and possibly vegetated building roofs. NIH will seek opportunities to implement innovative nonstructural stormwater management on a project by project basis for additional WQv credits.

The Bethesda campus is dynamic. More than 50 construction, renovation, and demolition projects are listed in the Master Plan. Several projects involving these activities are generally underway on campus at any given time. Some projects will involve both “new” and “redevelopment” aspects. Some areas will undergo several changes in perviousness status over a few years time. For example, the Building 14/28 complex will be demolished to make way for a new South Quad. The replacement buildings and underground MLP parking will be built over a period of several years. Portions of the Building 14/28 site may temporarily be used for parking or be converted to lawn. And NIH needs to record credits obtained for removal of surface parking in the buffer to compensate for increased impervious that may be created by new parking structures located elsewhere on campus.

The situation will be covered by an ISMP SWM tracking or “banking” system. The system is a ledger or account book that shows the status of campus management at any given time. The overall campus 3.30 acre-feet of channel protection or quantity control volume at the North SWM Facility and the 4.61 acre-feet of WQv establish “account” levels for the campus as a whole. Concomitant CPv and WQv would be determined for individual projects as they are implemented. If the projects are “new” ones, or “redevelopment” projects that do not reduce project site impervious area by 20 percent, then the computed project quantity and quality volumes would be deducted from the account values current at the time of project implementation. Volumes for projects that eliminate impervious surface, or reduce it by more than 20 percent, would be credited and added to the account CPv and WQ values. The current status ledger would be submitted to MDE with project computations to satisfy individual project MDE

stormwater management requirements.

Projects that will be completed prior to construction of the South Pond will have independent or individual water quality management facilities. These facilities will be "rolled over" into the banking system when the South Pond is in place.

5.4.6 Communications

Outside communication lines reach NIH via Verizon subsurface lines in Rockville Pike. Internal lines on the campus are owned and maintained by NIH. Communication lines on campus are routed through a complex network of 4" diameter conduits. Conduits are generally located under or immediately adjacent to the existing street grid. Conduits also carry the NIH fire alarm, security, and internal campus communications networks. Master Plan implementation impacts are minor; additional conduits would be needed in a few locations, particularly around the Clinical Research Center. Only a few minor relocations are needed to service proposed individual buildings.

5.4.7 Natural Gas, Fuel Oil, and Gasoline

Natural gas is supplied to NIH by Washington Gas mains running under Old Georgetown Road and West Cedar Lane. Washington Gas maintains 8" and 12" high pressure (200 psig) mains in Old Georgetown Road. Two 8" service mains branch from these mains and enter NIH at a Washington Gas pressure regulating station in the southwest corner of the campus along Old Georgetown Road. One of these 8" service mains, installed in 1992, supplies 100 psig natural gas to the power plant for boiler fuel. The other 8" main closely follows the southern boundary of the campus along the buffer area to Rockville Pike, which it subsequently crosses to supply gas to the Naval Medical Center.

The 6" service main from West Cedar Lane supplies low pressure gas (15 psig) to 38 campus buildings through a distribution system ranging from 3/8 inch to six inch size lines. There are about 15,000 linear feet of gas lines on the campus. Two to four inch service lines branch from the mains to individual buildings. Gas lines on the campus are owned and operated by WGL, although many smaller building service lines are owned and operated by NIH.

More than 99 percent of campus demand is for generation of steam in Building 11. Boilers 1 through 5 and the COGEN have dual natural gas - No. 2 distillate fuel oil burners. The estimated existing and projected Master Plan Alternative potential peak demands are given in Table 5-27. These correspond to the estimated potential peak steam demands that would occur when outdoor minimum daily temperatures reach 0° F assumptions include use of natural gas alone as the fuel supply, 85 percent plant efficiency, and 1,025 BTU per cubic foot of gas.

The existing potential peak natural gas demand is 684,000 CF/HR. The potential peak demand will increase sharply in the short term over the next few years as projects that are now under construction such as the Hatfield Clinical Research Center (135,000 CF/HR), COGEN turbine (126,000 CF/HR), and the Neuroscience Research Center, Phase I (34,000 CF/HR), Building 33 (19,500 CF/HR) are connected to the steam distribution system. Peak potential demand is expected to increase to more than 1,000,000 CF/HR by 2005. Cubic foot per hour natural gas demand or usage for generating steam at times other than the potential peak can be roughly approximated by multiplying the pounds per hour of steam demand given in Table 5-17 by 1.15.

The existing Washington Gas line to the campus is capable of delivering approximately 700,000 CF/HR to NIH. Estimated potential peak demand will exceed this physical capacity in the short term under both

<u>Year</u>	<u>Maximum Demand (CF/HR)</u>
2003	684,000
2005	1,032,000
End First Phase	1,011,000
End Second Phase	1,153,000
End Third Phase	1,229,000
End Final Phase	1,259,000

TABLE 5-27 PROJECTED MASTER PLAN PEAK NATURAL GAS DEMAND.

the Master Plan and No Action Alternatives. The estimated ultimate No Action Alternative peak potential demand is 1,033,000 CF/HR.

NIH is one of many customers served by the Washington Gas distribution mains outside the campus. Since NIH can use oil as an alternative fuel supply, natural gas service to NIH is curtailable by Washington Gas. During the winter, when Washington Gas demands are high, NIH may have to reduce or eliminate its use of natural gas. Curtailment is the prerogative of Washington Gas under the service contract, and generally occurs when the average daily temperature is below about 27° F. NIH operated exclusively on oil during three periods totaling 38 days while under curtailment in January and February 2003. Therefore, as a practical matter, natural gas delivery to NIH is usually curtailed before the physical line capacity is reached.

However NIH is constrained by how much fuel oil it can use during the year by boiler stack emission limits established in operating permits for nitrogen oxides (NOx). Burning fuel oil generates more NOx emissions per pound of steam produced than natural gas. For example, Boilers 1 through 5 produce about 2.6 times more NOx than natural gas for a given amount of steam generation.

NOx are precursor compounds for generation of ground level ozone. The Washington metropolitan area Air Quality Control Region has been classified by the U.S. EPA as being in "severe" non-attainment for ozone, i.e. regional ozone levels do not meet the Federal Ambient Air Quality Standards. While regional measures for reaching NOx attainment have been identified, there is some uncertainty regarding whether these measures will be sufficient or not. If they are not, the potential for reduction of emissions from all sources, stationary and mobile, exists.

The Master Plans for Bethesda-Chevy Chase and Bethesda Central Business District forecast continuing residential and commercial growth. Continued growth implies increased natural gas demand by customers outside NIH. If the gas distribution capacity is not increased, then curtailment of NIH supply can be expected to occur more frequently and for longer periods during each occurrence, regardless of growth in campus demands.

Considering both the regional NOx situation and natural gas capacity constraints, it is recommended that NIH pursue measures to obtain or guarantee a firm amount of natural gas supply that would not be subject to curtailment. The amount would be determined by analysis of projected conditions within and without the campus.

NIH must continue to maintain facilities for the delivery and storage of No. 2 distillate oil as an alternative backup supply of fuel for the boilers. Fuel oil is now stored in two 90-foot diameter underground tanks on the east side of Building 34. Each tank holds 500,000 gallons. The tanks were inspected and brought into conformance with Underground Storage Tank regulations in 1995.

Relocation of fuel oil storage facilities would be necessary under the Master Plan Alternative. This would permit realignment of Lincoln Drive and Service Road West in the vicinity of their intersection to form the Loop Road in this area. Refueling facilities located immediately adjacent to the Loop Road would be unsuitable.

The Master Plan would replace the tanks with new ones on the south side of Building 11 in a service area between that building and Building M in the South Quad. The relocation cannot occur until demolition of Building 14. The new tanks would be smaller in diameter, but have the same or similar combined capacity as the existing ones.

Tanker trucks would follow a one way path between Service Road West and Center Drive. It is estimated that under maximum potential steam demand conditions (0° F outdoor temperature) and full implementation of the Master Plan, the tanks would hold a little more than a four day fuel supply, and that approximately 27 trucks per day would be needed to maintain supply. Under more typical winter conditions, the tanks would hold about a ten day supply, and on the average, a 20 day supply, and the respective number of daily truck deliveries would be about ten and five.

The NIH gasoline station, which supplies fuel for government vehicles and grounds maintenance equipment, has two storage tanks. Each has a 10,000 gallon capacity.

5.4.8 Strategic Central Plant Operating Program

Management of the NIH central plant steam, chilled water, and electric power generation operations is rapidly increasing in complexity. Recently, or soon to be, installed equipment create options for running the plant. However, these options introduce new relationships among the utilities as well as boiler plant stack emissions. The amount of stack pollutants emitted by the boiler plant on an annual basis is limited or constrained. An important consideration in choosing an operation option on a given day, or strategically for the next few months or remainder of the year, is the cumulative amount of pollutants that have been emitted when the decision is made compared to the annual emission limits.

Selecting an option is no longer straightforward. Many factors are involved. To illustrate, the following are some of the factors that must now be taken into account:

- Steam may be generated using either boilers or the COGEN unit.
- Chilled water may be generated using steam or electric power.
- Electric power can be obtained from the COGEN unit or outside sources.
- Either fuel oil or natural gas may be used to generate steam, and electric power in the COGEN unit.
- Generation of electric power in the COGEN unit requires burning additional fuel.
- The burning of oil and natural gas produces stack pollutant emissions.
- For each pollutant, the stack emission rate per pound of steam or kilowatt of electric power generated by oil or natural gas differ. For example, making one pound of steam using oil generates more nitrogen oxides than using natural gas.
- For a given fuel, the boiler and COGEN emission rates for each pollutant differ. Smaller variances, as determined by annual monitoring, exist among the boilers.
- Current or contract oil, natural gas, and electric power prices, and their relationship to one another.
- Projected oil, natural gas, and electric power prices as indicated by commodity markets.
- The availability of natural gas and outside electric power through local utilities, or by contract from other entities at various terms for quantity and price.
- When NIH owns the COGEN unit, whether to sell the power generated, or use it internally within NIH.

- The extent to which past or future steam, chilled water, and power generation is affected by unusually hot or cold weather.
- Anticipated changes in utility demands created by scheduled new buildings, demolitions, and space use changes.
- Contingencies, such as outside utility curtailments or loss, or unexpected demand changes.

The above factors become increasingly important during those periods when campus demands approach plant capacity, i.e. just before new chillers or boilers go into service, or when emissions approach annual limits.

To resolve the situation, the Master Plan recommends the development of a Strategic Central Plant Operating Program (SCPOP). It is visualized as a computer program that would give the status of plant operations and emissions over any selected period of time. Input would include information on steam, chilled water, and power production, fuel and utility usage, prices, and also estimated stack emissions based on monitoring data. The status information could be used for preparing reports to regulatory agencies and internal NIH records. The program could also be tied to plant or distribution system metering or monitoring.

However, to be of maximum value, the program should also be a tool for strategic planning of operations over a future period of time. This can be done by creating a computer model of the plant. The annual cycle of demands can be projected or synthesized on a daily basis from past records. Equipment fuel, and emission characteristics can be modelled mathematically. The program should also have the ability to test various potential future operating scenarios on a user interactive basis, i.e. the user should be able to change all the variables involved. For example, for a desired test scenario, the user should be able to turn equipment on or off, run chillers on steam or electric power, select type of fuel to be used, add an anticipated demand, or change the price of oil or gas, all for testing any given day or period.

Output would include the effects of the test scenarios on plant stack emissions, or on operating costs.

5.4.9 Compressed Air

Air is compressed to 125 psi in the central plant for subsequent delivery to the Clinical Center and laboratory buildings. It is distributed to the Clinical Center and laboratories north of the central plant via pipes in the steam/chilled water tunnel running between the power plant and the Clinical Center. This line extends to Building 6. A branch main and network services Building 34 and the laboratories on the west side of the campus. A second branch network services laboratories, animal care spaces and Building 38 to the south of the plant. Delivery pressures are approximately 110 psi.

Air is used primarily for laboratory experiments and processes. New individual laboratory building service laterals would be needed if the Master Plan Alternative is selected. NIH is currently doubling the compressed air generation capacity, and replacing the distribution system.

5.5 NOISE

5.5.1 Guidelines and Criteria

Noise levels vary continuously with time. Various measurable descriptions of noise are used to account for this variance with time. Leq is the average mean square sound level measured in decibels over a time period of consideration, usually one hour. Ldn is the 24-hour average sound level for the period from

midnight to midnight obtained after adding a 10 decibel "penalty" to sound levels recorded or computed for the period from midnight to 7 AM and from 10 PM to midnight.

L₁₀, L₅₀, and L₉₀ are sound pressure levels that are exceeded 10, 50, and 90% of the time, respectively.

Noise levels are measured in A-weighted decibels (dBA), which match the sensitivity of the human ear across the frequency spectrum. It is a logarithmic measurement. A 3 dBA increase is equivalent to a doubling of the sound pressure level or loudness. Conversely a 1 or 2 dBA increase is barely perceptible to the human ear.

Noise criteria have been established by different agencies depending on noise source and land use. Traffic noise impact criteria have been established by the Federal Highway Administration (Federal Aid Policy Guide, FHWA). Impacts are expected to occur if the peak hour Leq exterior noise level exceeds 67 dBA for activity areas such as residences, schools, churches, libraries, hospitals, hotels, motels, parks, playgrounds, and recreation areas, or if there is an increase of 5 dBA or more. Other federal agencies define noise criteria in terms of Ldn (Guidelines for Considering Noise in Land Use Planning and Control, Federal Interagency Committee on Urban Noise, 1980). U.S. Department of Housing and Urban Development, the U.S. Department of Transportation, and EPA recognize an Ldn of 55 dBA as a non-regulatory goal for outdoor residential areas.

The Guidelines indicate proposed activities are compatible with the following land uses provided the indicated Ldn is not exceeded:

Residential	65
Hospitals	65
Schools	65
Churches	65
Government Services	70
Parks, Recreational Areas	75

Acceptable noise levels at residential property lines are:

	<u>Day</u>	<u>Night</u>
Maryland (COMAR 26.02.03.03)	65 dBA	55 dBA
Montgomery County	62 dBA	55 dBA

5.5.2 Traffic Noise

To characterize the existing noise environment in the surrounding neighborhoods, Leq noise levels were measured at eight representative receptor locations. Measurements were taken using a RION-N4 meter meeting ANSI Type 2 criteria. Leq, L₁₀, L₅₀, L₉₀, and Lmax values were measured using FHWA criteria for measuring traffic noise. Traffic data during measurement periods was recorded. It was determined that Leq noise levels on Rockville Pike and Old Georgetown Road were relatively constant throughout the day, i.e. Level of Service C traffic produced noise levels equivalent or close to those recorded during the peak hour. This is attributable to the frequent acceleration and deceleration of vehicles at the closely spaced signalized intersections, and a greater number of trucks in the traffic during the non-peak hours.

The dominant source of noise in the vicinity of NIH is produced by traffic on Rockville Pike and Old Georgetown Road. Time averaged noise levels adjacent to these two arterials are relatively constant between 6 AM and 9 PM on weekdays. Values may be only one or two dBA higher during short term

peak noise periods. At the building line adjacent to these roads, Leq noise levels are generally 68 to 71 dBA (Table 5-28). Under Similar conditions, noise levels on Jones Bridge Road and West Cedar Lane are 66 and 64 dBA, respectively.

Internally within the core area of the campus, numerous sources contribute to the overall noise environment. Noise from traffic exterior to the campus dominates noise levels on the campus for a distance extending 500 feet into the campus. Campus traffic is comparatively light, particularly during the middle of the day, and moves at low speeds. Noise from the passing of individual groups of vehicles can be recorded. Since campus traffic is not sufficiently high to create a noise continuum, other sources can be heard. These include human activities, mechanical equipment, and grounds maintenance. Measurements taken in 1987, 1992 and 1993 at many locations at various times of the day indicate that typical day time (Ld) noise levels range from 55 to 60 dBA throughout the core area. Construction is generally underway around the campus on a continuous basis at one location or another. Where this occurs, Leq noise levels are elevated 2 to 5 dBA locally. Night time (Ln) noise levels range from 45 to 55 dBA. Night time levels are about 5 dBA higher in the immediate vicinity of the Clinical Center. Leq noise levels in the 45 to 50 dBA range were recorded along the northern periphery of the site in areas beyond the direct influence of traffic noise from Rockville Pike and Old Georgetown Road in the early morning hours (1 AM to 4 AM)

Another minor source of periodic source of noise is two METRO subway fan shafts located near the station entrance. When operating, fans in the shafts produce a steady mechanical drone of 70 dBA. They operate automatically when tunnel or station ventilation is needed. The length of the operational period is variable depending on the number of trains and ambient weather. A single operating cycle may last for an hour or more followed by several hours of silence. Noise from the shafts is projected upward and has little influence on ambient levels at the ground level beyond a radius of about 50 feet.

Traffic noise predictions were determined by using the FHWA TNM 1.1 Traffic Noise computer model, which includes information on traffic volumes, mix and speeds, and roadway and receptor geometry as inputs. The model also accounts for vehicle deceleration and acceleration at signaled intersections. Existing and future Master Plan and No Action Alternative traffic volumes on roadway links around the campus used in the analysis are given in Section 5.3.6. Existing volumes are based on a field survey or count; future volumes are projected based on NIH and background or non-NIH growth in trip generation. Data for the peak PM hour was used. The vehicle mix (cars, medium and heavy trucks, and motorcycles) used in the analysis for Rockville Pike and Old Georgetown Road is based on data derived by the Metropolitan Washington Council of Governments (MWCOC) for Montgomery County arterial roadways. The vehicle mix for other roadways was determined by field survey.

Traffic generated by implementation of the Master Plan will not create noise impacts on the surrounding neighborhoods (Table 5-29). Noise levels will increase by 2 dBA or less regardless of whether the Master Plan or No Action Alternative is selected. One or two dBA differences are not readily discernable to the human ear. Traffic volumes must double or halve to produce a 3 dBA increase or decrease, respectively. Even with projected non-NIH growth in the Bethesda CBD and Rockville Pike corridor, traffic volumes are not expected to double..

Predicted noise levels are typical for urban arterials and collector-distributor roadways. Predicted levels are representative of those experienced at residences and buildings directly fronting the streets at 50 to 100 foot setbacks from the curb line. Residences screened by a row of houses will experience levels 5 dBA less than indicated. In those locations where traffic generated noise dominates or is the prime contributor to overall noise levels, future noise levels will remain unchanged. This includes all areas within about 600 feet of Rockville Pike, Old Georgetown Road, and Cedar Lane.

Site	Time	L95	L90	L50	L10	L5	Lmax	Leq
1 Stone Ridge School	5:38-5:53 PM	58	58	61	63	63	66	61
2 Locust Hill Estates	8:20-8:35 AM 9:47-10:02 AM	61 60	62 61	66 68	71 74	72 74	91 83	68 69
3 Carriage Hill Elderly Care	10:10-10:25 AM	55	56	62	68	70	79	64
4 Alta Vista	9:30-9:45 AM 4:38-4:53 PM	57 59	60 60	67 68	73 72	74 73	82 105	69 69
5 Beth El Temple	10:44-10:59 AM	59	61	69	75	76	83	71
6 East Bethesda Wisconsin Avenue	3:22-3:37 PM 4:39-4:45 PM	58 58	60 60	68 69	73 74	74 75	82 81	70 70
7 East Bethesda Jones Bridge Road	2:50-3:05 PM	59	60	64	69	71	82	66
8 East Bethesda Windsor Lane	4:06-4:21 PM	55	56	59	64	65	75	61

TABLE 5-28 1993 Leq TRAFFIC NOISE MEASUREMENTS (in dBA).

Site/Community	2003 Existing	No Action Alternative	Master Plan Alternative
Stone Ridge School And Convent Of The Sacred Heart	59	60	60
Locust Hill Estates Residences East Side Rockville Pike	68	69	70
Maplewood Carriage Hill Elderly Care Residences North Side Cedar Lane	66	66	67
Alta Vista Residences Either Side of Old Georgetown Road	68	70	70
Suburban Hospital	61	63	63
Greenwich Park at Old Georgetown Road End of Park	65	66	66
Edgewood/Glenwood Bethesda United Methodist Church Wesley Nursery School & Residences Facing Old Georgetown Road	66	67	68
Beth El Temple & Congregation Beth El Day Care	67	69	69
East Bethesda Residences Facing Wisconsin Avenue	68	68	70
East Bethesda Residences Facing Jones Bridge Road East Of Glenbrook Parkway	68	69	70

TABLE 5-29 EXISTING AND PROJECTED TRAFFIC Leq NOISE LEVELS (in dBA)

Vehicles associated with the Gateway Center garage and the Commercial Vehicle Inspection facility are included in the analysis. They have no impact on noise levels because they comprise only a small fraction of the total traffic.

5.5.3 NIH Chilled Water Plant Noise

The NIH central refrigeration plant produces chilled water in two plants, No. 1 in Building 11 and No.2 in Building 34. Chilled water is generated through the combined use of chillers and cooling towers. Currently, there are ten chillers inside Building 11, and six in Building 34. Two cooling towers located on the roof of each building are associated with each chiller, i.e. 24 cooling tower cells.

The number of chillers and cooling towers that are operating fluctuates with the outdoor temperature. When the temperature exceeds 95 ° F, all or nearly all of the units are in service, at lesser temperatures, fewer units are needed and typically one half of the units may be in service when downtime temperatures are around 75 ° F. The plant operates throughout the year even on the coldest days in the winter to accommodate the campus base or process chilled water load. Operations also vary diurnally as daily temperatures rise and fall.

Noise levels were monitored on seven occasions for up to a week at Site A and along the southern NIH property line between 1987 and 1994 (Figure 5-16). The general Leq day time noise level at Site A was consistently 59 to 60 dBA unless the NIH chilled water plant was operating at near capacity. In July 1993, a one hour Leq of 62.4 dBA was recorded at Site A when the outdoor temperature was 95 ° F. One week of continuous monitoring in August 1994 recorded the average day time Leq noise level at 61.9 dBA between 6:00 AM and 9:00 PM, and an average night time noise level of 60.0 dBA (9:00 PM to 6:00 AM).

A review of the noise data revealed a complex noise environment at Site A and at residences on the north side of McKinley Street in Glenwood. The composite or overall noise in the area has several components: background noise comprised of Old Georgetown Road traffic noise and other noise and noise produced by the NIH chilled water plant with facilities in Buildings 11 and 34 making separate contributions.

Noise generated by Old Georgetown Road traffic dominates and governs the overall ambient noise levels over an area extending about 600 feet to the east of the roadway. It is dominant in this area at all times of the day. The combination of vehicle volumes and speeds is such that noise generated by this traffic is relatively constant with a variance of only 1 to 2 dBA from 6 AM to 9 PM. Noise levels drop from 3 to 6 dBA during the remaining hours. Weekend noise levels, both day and night, are about the same as weekday levels.

Background noise includes noise not specifically accounted for. It includes working hour NIH campus traffic (48 dBA), NIH electrical and mechanical equipment, transformer hum from PEPCO facilities in Building 46, children playing at the NIH child care center, birds singing, insects, aircraft over flights, sirens on ambulances and fire engines, residential air conditioners, dogs barking, lawn mowers and leaf blowers, vehicles on McKinley Street, and many human activities including pedestrians passing Site A on nearby footpaths. None of these sources dominates the background levels individually or is continuous, but all contribute to it.

The principal sources of exterior noise are the cooling towers located on the roofs of the two buildings. The towers have three separate subsources of noise: tower fans and motors, water splashing in towers trays, and high velocity air passing through the tower and its fans (Figure 5-17). The fans and motors

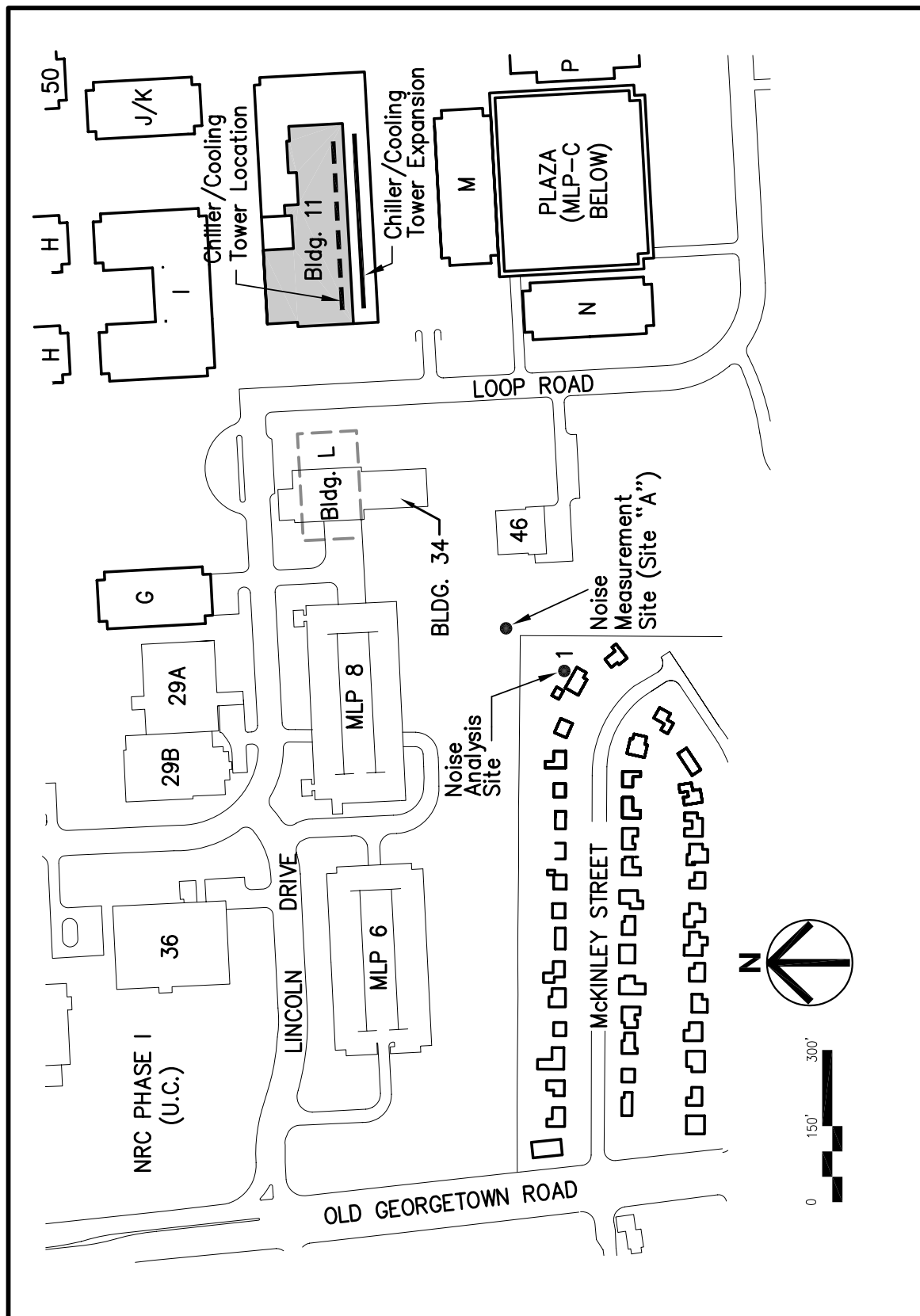


FIGURE 5-16 NOISE IMPACT SITE EVALUATED IN GLENWOOD.

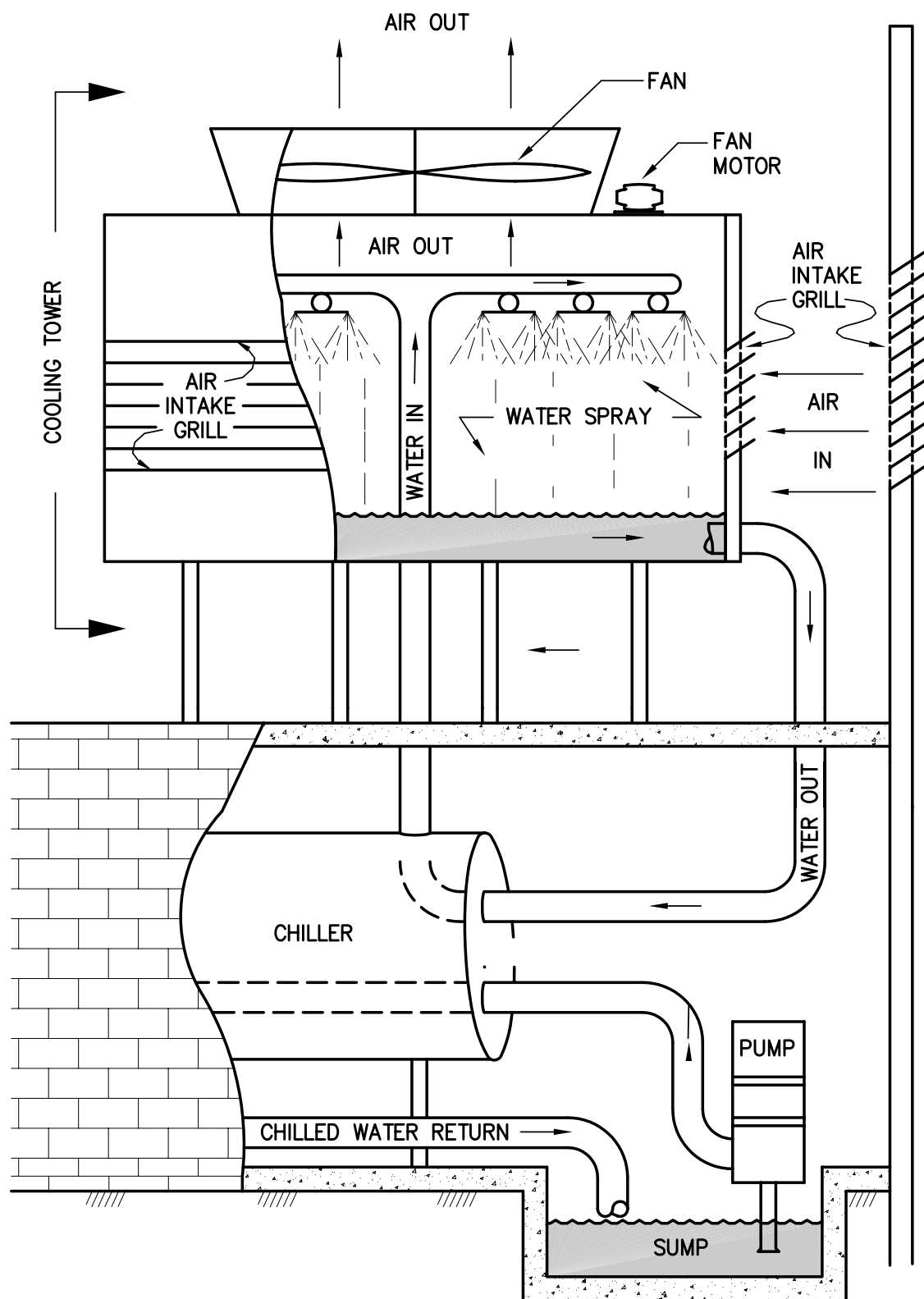


FIGURE 5-17 REFRIGERATION PLANT SCHEMATIC.

produce a steady drone. The splash of water in the trays generate tones similar to a waterfall. The air flow noise is similar to the moan produce by high winds.

The noise levels produced by a cooling tower unit are the logarithmic sum of these three subsources. Total plant noise varies incrementally with the number of units in service. Reference Leq noise levels were obtained for NIH tower operations by recording levels when one, two, and three units were in operation.

Observation of the monitored noise levels and field conditions indicated that the NIH chilled water plant produced different noise impacts at different times. Except for summer, noise produced by the plant during the day time was submerged within the overall noise environment and the plant was not a primary contributor. During the summer months, when temperatures exceed 90 ° F, plant noise increases as the number of units in service increase. During the day, plant noise is equivalent to all other noise sources combined in terms of loudness. It is during the summer night time (9:00 PM to 6:00 AM) when plant noise becomes most evident. Although the plant produces less noise during the night time hours than during the day, the noise from all other sources decreases to a greater extent, and plant noise becomes the dominant or loudest contributor to the overall noise environment.

In order to determine the relative merits of potential mitigation options for the plant, an analysis of the existing noise environment was conducted. The analysis was based on partitioning the week long day-night time Leq noise levels monitored at Site A into its contributing components (daytime 61.9 dBA, night time 60.0 dBA). The contributing components were cooling tower noise, Old Georgetown Road traffic noise, and other background noise. The first two can be determined by computer modelling, the last is what is unaccounted for.

This was done by using the FHWA STAMINA 2 noise prediction computer model, which is normally used to predict noise generated by traffic on roadways. Conditions were simulated by modelling Old Georgetown Road and its traffic conventionally, the residences in Glenwood, existing campus roads and buildings such as MLP-6, MLP-8, the PEPCO substation in Building 46, and topography in the vicinity of Site A.

Buildings 11 and 34 were also modelled. Cooling tower cells were modelled as individual line sources with a length equal to the cell width. The three tower noise subsources were modelled separately, so that each tower was represented by three line sources. The analysis included all chillers/towers through Unit 27. These units face to the south. Towers 28 through 32 would be located on the east side of the plant and face in that direction, and have no effect on noise to the south or west of the plant.

The model was then calibrated until the noise levels at Site A under a variety of operating conditions (peak, nonpeak, day, night) could be reproduced. Day and night time peak operating Leq noise levels, or maximum impact conditions, are shown in Table 5-30. The existing data represents conditions that were present at the time of the analysis. It shows that NIH chilled water plant noise becomes the dominant source in the night time on hot summer days. Day and night time plant noise levels during the non-summer seasons are 2 to 5 dBA less.

NIH incorporated noise attenuation in the design of the Building 11 expansion and installation of new equipment as mitigation in the 1995 Master Plan EIS. Phase I and II chilled water plant expansion has been completed. Chillers 22 through 25 went into service in 2002 and Chillers 26 and 27 are scheduled for service in 2004. The new cooling towers associated with these chillers operate more quietly than older towers. Each unit produces about 6 dBA less noise. A 60-foot high louvered acoustical screen running the length of the south side of Building 11 has also been installed as part of the project.

	EXISTING	MASTER PLAN
Peak Day Time (6 AM-9 PM)		
Background noise	57.6	57.6
Building 34	56.2	--
Building 11	57.2	49.6
Total CHW Plant	59.7	49.6
Plant and Background	61.9	58.2
Peak Night Time (9 PM-6 AM)		
Background noise		
Building 34	54.3	54.3
Building 11	50.9	--
Total CHW Plant	57.2	48.9
Plant and Background	58.1	48.9
	59.6	55.4

TABLE 5-30 EXISTING AND PROJECTED PEAK DAY AND NIGHT TIME Leq NOISE LEVELS AT GLENWOOD PROPERTY LINE (in dBA).

NIH retrofitted screening around the cooling towers on the roof of Building 34 in 1994. The screening reduces noise levels by about 2 dBA. The chillers in Building 34 will be operated less as the number of units in Building 11 increases. The Building 34 units will primarily operate as peak service units, or only during the day time on those days when peak campus demand approaches plant capacity. The six chillers would eventually be decommissioned and removed, and Building 34 would be converted to a campus center.

The total net attenuation produced at Site A under peak or high outdoor temperature conditions by quieter operating towers and the acoustical screen will be about 10 dBA in plant noise. Day time plant noise would decrease from 59.7 to 49.6 dBA. Overall, however, only a 3 to 4 dBA improvement in the noise environment will be realized as unattenuated background noise begins to dominate the acoustical environment. However, noise generated by the plant will contribute significantly less to the overall or total noise environment. This mitigation would occur under both the Master Plan and No Action Alternatives.

It is only when all cooling tower units are running that the combined or cumulative noise produced becomes significant. Operationally, it will be relatively immaterial which of the towers are run to meet a less than capacity cooling load due to the distance between Building 11 and Glenwood. Noise levels decrease by 3 dBA for each successive doubling of distance between source and receiver (i.e. 100, 200, 400, 800 feet). The westernmost (Chiller 22) and easternmost (Chiller 27) ends of the plant, for example, are about 700 and 1,000 feet distant from Site A, respectively. The estimated unattenuated combined effect of Cooling Towers 22 and 23 at the west end would be to produce Leq noise levels of 52.2 dBA at Site A. Towers 26 and 27 at the east end generate 50.7 dBA, a barely discernable audible difference. Towers further east than unit 27 will be physically screened as viewed from Site A by other towers and buildings.

In contrast to Site A, Leq noise levels on the north side of Building 14 will be high, and operation of individual tower units does make a difference in the noise environment. Construction of the chilled water

plant expansion reduces the wall to wall distance between Building 11 and 14 from 90 to 30 feet. The source-receiver distance is so small that the Leq noise level of any point along the north face of Building 14 is determined by the nearest operating tower cell.

The unattenuated Leq noise level at the center of the north face of Building 14 is estimated to be 84 dBA, if the plant were operating at capacity with all towers in service. The noise screen reduces the level to 76 dBA, which is only half as loud or intense as levels were prior to installation of the noise screen. However, at operations less than capacity, the Leq noise level at any point opposite the center of a single operating tower cell will be 72 dBA due to the distance factor. Similarly, if the point is centered on two or three adjacent operating tower cells, the resultant noise levels are 74 and 75 dBA, respectively.

This condition would continue permanently under the No Action Alternative. The Master Plan Alternative proposes replacing Building 14 with Building M. The north wall of Building M would be about 130 to 140 feet from Building 11. The projected maximum future Leq noise level at Building M is 65 dBA, an acceptable level in an urban environment. This would occur under high summer temperature conditions.

5.5.4 On Campus Noise

In general, the future campus noise environment for both alternatives will be similar to existing conditions, since no one source of noise dominates and no new significant noise source will be created. Traffic noise levels increase with vehicle volume and speed. A doubling of vehicle volume increases noise levels by 3 dBA, if all other factors are held constant. Gateway Center and Commercial Vehicle Inspection Facility traffic volumes are low in comparison to volumes on adjacent Rockville Pike and move at lower speeds. Noise levels in the Rockville Pike corridor are dominated by the set by Rockville Pike traffic. Noise levels in the east side buffer area will be unchanged by these projects.

Typical Ld noise levels will continue to be in the 55-60 dBA range and Ln levels in the 50-55 dBA range in the core area away from the influence of the road network surrounding the campus.

Current and future peak hour traffic entering and leaving the campus is constrained by the MOU trip limits. Internal campus traffic volumes under the No Action and Master Plan Alternatives will be similar to existing conditions. Currently, most vehicles make short internal campus trips to the nearest peripheral surface parking. In the future, under the Master Plan the pattern will be similar except that the vehicles will proceed to structured parking along the Loop Road.

The estimated Loop Road peak hour traffic volume for the links and sections in the southwest quarter of the campus is about 1,100 vehicles per hour under the Master Plan buildout conditions. The predicted Leq noise levels generated by these vehicles at the property line nearest to the Loop Road on the east side of Edgewood/Glenwood is 49 dBA. This is significantly less than the combined day time noise levels produced by Old Georgetown Road, the chilled water plant, and background noise from all other sources (57 dBA).

No specific exterior-interior noise attenuation need be included in the design of buildings proposed in the Master Plan, including those immediately to the north and south of Building 11. The proposed buildings closest to Building 11 partially or totally screen those farther from Building 11.

5.6 AIR QUALITY

5.6.1 Regional Conditions

The Federal Clean Air Act of 1970 requires that air quality in designated Air Quality Control Areas (AQCA) meet the National Ambient Air Quality Standards (NAAQS) (42 U.S.C. § 7407). NAAQS criteria pollutant standards are shown in Table 5-31. Primary standards are based on health effects, secondary standards on environmental effects. For several pollutants, these standards are the same. If the standards are not met, then the AQCA is in "non-attainment". The one hour ground level ozone (O₃) standard applies to areas that are in non-attainment for ozone. The eight-hour standard, issued by U.S. EPA in 1997, was intended as a replacement for the one-hour standard in those areas where the one-hour standard is attained. Amendments to the Clean Air Act require the AQCA to develop an air quality State Implementation Plan (SIP) that indicates how the NAAQS will be "attained" (42 U.S.C. § 7502). Non-attainment areas are classified as marginal, moderate, serious, severe, and extreme.

The Washington metropolitan area extending from Frederick County, Maryland to Stafford County, Virginia, and from Calvert County, Maryland to Loudoun County, Virginia comprises the National Capital Interstate (NCI) AQCA. Maryland, Virginia, and the District of Columbia each have AQCA's within the National Capital Interstate AQCA. NIH is located within Maryland AQCA IV, which covers Montgomery and Prince George's Counties. Since 1990, ozone concentrations in the National Capital Interstate AQCA have exceeded the NAAQS on an average of six days per year.

Since non-attainment involves all of the regional jurisdictions, a Metropolitan Washington Air Quality Committee (MWAQC) was formed by the governors of the two states and the Mayor of Washington, D.C. to develop a regional strategy to reach ozone attainment. Committee membership is composed of local jurisdictions within the regional AQCA as well as the air management agencies for each State and the District. The MWAQC recommendations are forwarded to the three State air quality agencies for approval. In Maryland, the Department of the Environment (MDE) is the controlling agency.

Ground level ozone is generated when nitrogen oxides (NO_x) combine with volatile organic compounds (VOC) at times of persistent high temperature, abundant sunshine and prolonged periods of air stagnation. Ozone generation is therefore controlled indirectly through control of NO_x and VOC emissions. In 1990, the NCI AQCA emitted an estimated 729 tons of NO_x and 527 tons of VOC per day. Control measures to reduce VOC emissions were proposed in the Final State Implementation Plan (SIP) to Achieve a Fifteen Percent Reduction in VOC Emissions for the Washington Non-Attainment Area, MWCOG, 1994. This SIP is also known as the "15 percent Plan". Further NO_x and VOC control measures were proposed in SIP Revision, Phase I. Target emission goals for 1999 for the SIP and SIP Revision Phase I were 615 and 380 tons per day for NO_x and VOC, respectively.

Computer modelling indicated that these inventory emissions would result in regional ozone concentrations that met the NAAQS criteria. However, the MWAQC claimed that up to one-third of ozone pollution within the region arrives from upwind sources outside the NCI AQCA resulting in continuing non-attainment. The MWAQC prepared a plan for the outside sources (Washington SIP Revision Phase II, Attainment Plan, MWCOG, 2000). The Phase II Plan projected "budget level" NO_x and VOC emissions for the year 2005 were 418 and 355 tons per day, respectively, and attainment by that date.

The degree of ground level ozone pollution in a region is characterized by its ozone "design value". The ozone design value for an AQCA is defined as the highest of the fourth highest one-hour daily maximum ozone concentrations recorded over a given three year period at individual monitoring stations within the

Pollutant/ Averaging Time	Ambient Standard(s)****				Monitoring Data		
	Primary		Secondary		Maximum Concentration		Location Dist./Dir.*** (Year)
	(ug/m ³)	(ppm)	(ug/m ³)	(ppm)	(ug/m ³)	(ppm)	
<u>Carbon Monoxide (CO)</u> 1-Hour*	40,000	35	---	---	3,900	3.3	McLean Gov't Ctr 6 mi/SW(2002)
8-Hour*	10,000	9	---	---	2,700	2.3	McLean Gov't Ctr 6 mi/SW(2002)
<u>Sulfur Dioxide (SO2)</u> 3-Hour*	---	---	1,300	0.50	86	0.033	Balls Mill 7 mi/SW(2002)
24-Hour*	365	0.14	---	---	47	0.018	Balls Mill 7 mi/SW(2002)
Annual	80	0.03	---	---	18	0.007	Balls Mill 7 mi/SW(2002)
<u>Nitrogen Dioxide (NO2)</u> Annual	100	0.053	100	0.053	38	0.020	Balls Mill 7miSW(2002)
<u>Ground Level Ozone (O3)</u> 1-Hour**	235	0.12	235	0.12	209	0.110	Rockville Env. Center 8 mi/N(2002)
8-Hour**	157	0.08	157	0.08	188	0.099	
<u>Particulate (PM10)</u> 24-Hour*	150	---	150	---	45	---	Chantilly 20 mi/SW(2002)
Annual	50	---	50	---	18	---	Chantilly 20 mi/SW(2002)
<u>Particulate (PM2.5)</u> 24-Hour*	65	---	65	---	35	---	McLean Gov't Ctr 6mi/SW(2002)
Annual	15	---	15	---	14	---	McLean Gov't Ctr 6mi/SW(2001)
<u>Lead (Pb)</u> Quarterly	1.50	---	1.50	---	---	---	Not monitored regionally
<p>Notes: * short-term (1-hour, 3-hour, 8-hour and 24-hour) standards are not to be exceeded more than once per year. Therefore, second-highest annual values are compared to the standards rather than the highest.</p> <p>** 3-year average of 4th highest annual concentration may not exceed standard. 1-hour standard applies to areas in ozone non-attainment; 8-hour standard to those meeting 1-hour standard.</p> <p>*** Approximate distance and direction from NIH.</p> <p>**** The State of Maryland has adopted the National Ambient Air Quality Standards (NAAQS) as the state standard.</p> <p>(ug/m³) = micrograms per cubic meter. (ppm) = parts per million</p> <p>Source: Maryland and Virginia Annual Air Quality Data Reports</p>							

TABLE 5-31 AMBIENT AIR QUALITY STANDARDS AND EXISTING AIR QUALITY DATA.

AQCA. An area is in ozone attainment if the design value is 0.12 parts per million (ppm) or less. In 1989, the design value for the Washington area was 0.165 ppm. The design values for 17 monitoring stations within the NCI AQCA for 1997 through 1999 ranged from 0.114 to 0.132 ppm.

In January 2003, while noting this regional progress in reducing ozone, levels, the U.S. EPA determined that the Washington area had failed to meet the one-hour NAAQS by the November 15, 1999 deadline prescribed by the Clean Air Act (CAA) for serious non-attainment areas. The Washington area was reclassified as being in “severe” non-attainment.

The effect of the reclassification to “severe” is to set a new attainment deadline of November 15, 2005. It also requires the preparation of a SIP revision that meets CAA provisions for severe ozone non-attainment area SIPs. These include development of a regional ozone attainment inventory, and specific control measures. The MWCOG Metropolitan Washington Air Quality Committee approved a revised "Plan to Improve Air Quality in the Washington, D.C.-MD-VA Region" ("Severe Area SIP") in February, 2004. Since MD AQCA IV and NCI AQCA are not in ozone attainment, federal actions involving new sources must demonstrate conformity with the non-attainment AQCA SIP for the pollutant, which is in non-attainment (CFR 40§ 93, 158). For ozone, this can be achieved by meeting any of the following:

- Direct or indirect emissions of the action are specifically identified and accounted for in the SIP or AQCA permit inventory.
- For ozone or NO_x, the total direct or indirect emissions from the action must be fully offset within the non-attainment area so that there is no net increase in emissions.
- The State air management agency (MDE) determines or documents that emissions combined with all others would not exceed non-attainment budgets given in the SIP.

NIH is under the jurisdiction of the Maryland Department of the Environment (MDE) for air quality permitting and regulations. MDE maintains the SIP for the Maryland portion of the regional AQCA as well as the State NO_x allowance banking (NATS) and NO_x emissions tracking (NETS) systems. NIH stationary source emissions are identified and accounted for through the MDE permitting process.

Air quality data recorded at monitoring stations representative of conditions at NIH Bethesda are shown in Table 5-31. Maryland no longer monitors carbon dioxide, sulfur dioxide, nitrogen dioxide, or 2.5 micron particulate matter in the Washington region. The Chantilly, Balls Mill and McLean Government Center stations are in the Virginia monitoring network. These stations are located in Fairfax County, a mile or two inside the Washington Beltway. The mix of commercial and residential development in the vicinity of these stations is similar to that at NIH Bethesda. The location of the station in relation to prevailing winds crossing the NCI AQCA are also similar to NIH's position.

The ground level ozone monitoring station nearest NIH Bethesda is located in Rockville, Maryland. Although the region is in non-attainment, monitored one-hour ozone levels at this station are consistently below the NAAQS. The second highest maximum one-hour zone concentration of 209 micrograms per cubic meter is equivalent to a concentration of 0.11 ppm. The eight-hour maximum concentration is given for reference only as this NAAQS is not applicable to areas in non-attainment for ozone.

There are two primary emission sources at NIH:

- Traffic coming to and departing from the campus, which adds, exhaust emissions to the general traffic on arterial roadways.
- The central heating plant boilers which produce emissions from the combustion of oil and gas

5.6.2 Mobile Source Air Quality

5.6.2.1 Traffic

Traffic related air quality impacts are considered on two scales; the mesoscale or regional level, and the

microscale or local level. Regional impacts are generally assessed in the SIP in terms of total regional vehicle miles of travel producing tons of pollutants such as carbon monoxide (CO) and NOx per year. In urban areas, traffic generated by individual projects has little or no influence at the regional level.

Projects are therefore evaluated at the microscale level, and an analysis of CO is typically made to assess whether local violations of the NAAQS will occur. CO is used as the reference criteria pollutant for traffic microscale air quality analysis because it is the standard that will always be exceeded first as a result of vehicle emissions.

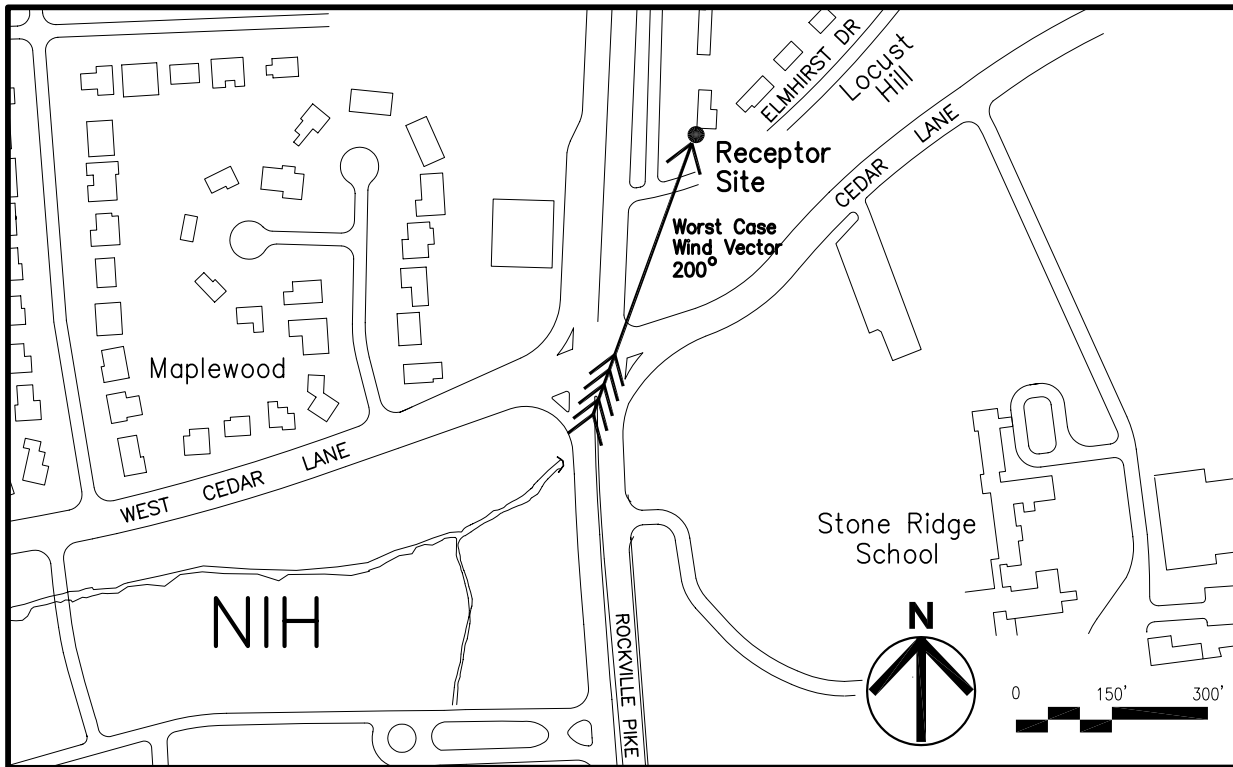
To assess traffic related air quality impacts associated with NIH, a "worst case" microscale analysis was conducted using EPA approved methodology and computer models. Eight potential study sites were evaluated on a preliminary basis. From these, two receptor sites with the highest potential CO concentrations were selected for more detailed study. The two sites are near intersections where they are subject to vehicle idling as well as running emissions. The first, Site 1, is a single family, detached residence on the north side of West Cedar Lane closest to the Rockville Pike/Cedar Lane intersection. The Rockville Pike/Cedar Lane intersection has the highest existing and future total and NIH-generated traffic volumes. The second site is a townhouse in a development to the southeast of the Rockville Pike/Jones Bridge/Center Drive intersection. The total and NIH traffic volumes at the Jones Bridge/Rockville Pike intersection are less than at the Cedar Lane intersection, but the townhouse is closer to the intersection travel lanes than the residence at Site 1. Site locations are shown in Figure 5-18.

CO concentrations were determined in a two step process: (1) determination of vehicle emission factors or rates in terms of grams per vehicle mile of travel using the EPA MOBILE6.2 Mobile Source Emission Factor Model computer program, (2) these emission rates were then inputted into the computer model, CALQ3HC Version 2.0, Traffic Pollutant Dispersion Model, along with traffic data, site geometry, and weather data. Both programs are approved by the U.S. FHWA and U.S. EPA for determining traffic related air quality impacts. Concentrations were determined for existing 2003 conditions, and for ultimate conditions in 2023.

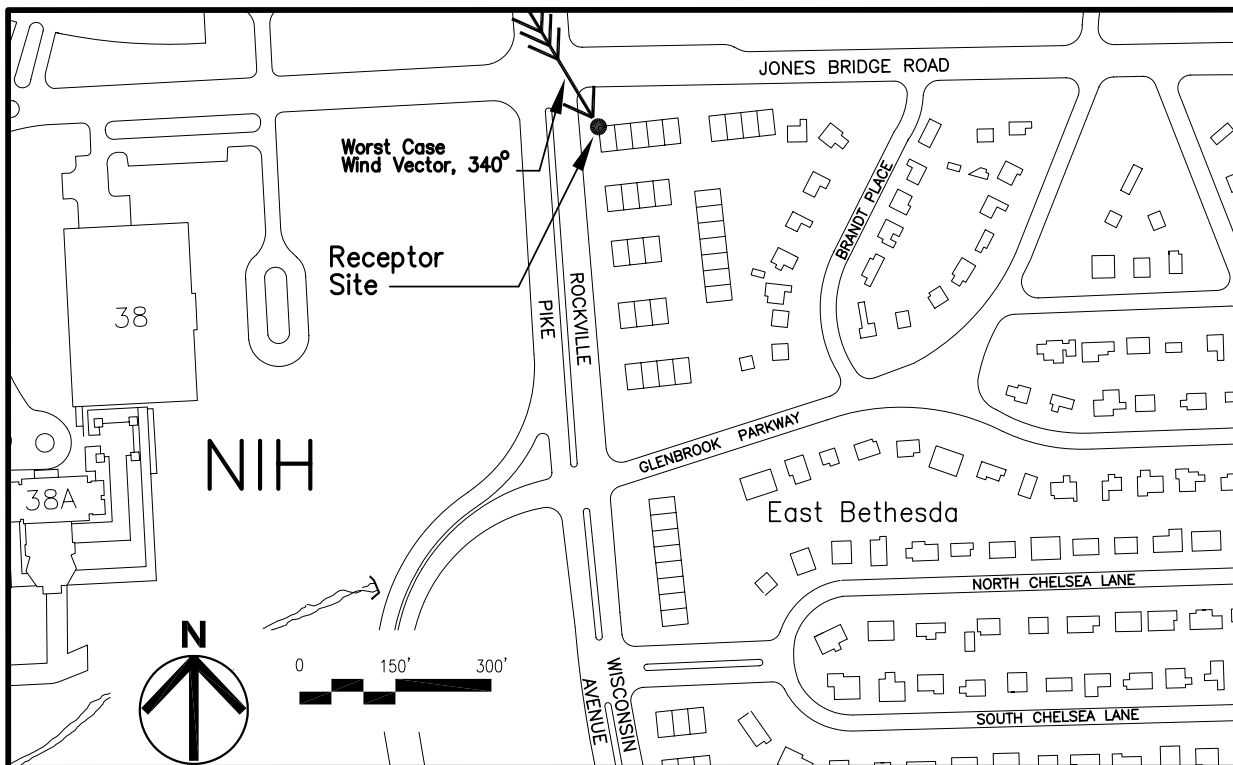
The sites were analyzed as an intersection with both moving and idling vehicles contributing to resultant concentrations.

Most of the data used in the MOBILE6.2 emission factor analysis was adopted directly from that used in the regional air quality conformity analysis "Severe Area SIP" (See "Plan to Improve Air Quality in the Washington, D.C.-MD-VA Region, Appendix B, MWCOG, 2004). Data used directly included:

- Southern reformulated gasoline program.
- Regional weekday vehicle trip length distribution.
- Maryland vehicle exhaust/evaporative Inspection/Maintenance program including Maryland IM240 output points.
- Maryland implementation schedule (from LEV to Tier 2 in 2004).
- Maryland anti-tampering program.
- Montgomery County vehicle registrations.
- Montgomery County diesel fractions.
- Fuel RVP at 7.8.
- Soak distributions - The Appendix B procedure was used for background traffic. NIH traffic leaving the campus was assumed to be running five minutes after start up. The remaining parameters other than those given below were set at EPA default values.



Receptor site at Rockville Pike/Cedar Lane intersection.



Receptor site at Rockville Pike/Jones Bridge Road intersection.

FIGURE 5-18 TRAFFIC AIR QUALITY ANALYSIS SITES.

The following were adjusted for local site conditions:

- Calendar years - 2003 and 2023.
- Temperature - 35° F.
- Vehicle speed – 2.5 mph emission factor for vehicles idling in traffic signal queues, and 25 mph for free flowing traffic. (See User's Guide to [MOBILE6.1](#) and [MOBILE6.2](#), EPA420-R-2-028, 2002)
- Vehicle mix - the MWCOG Appendix B vehicle mix for Montgomery County local analysis was used, but adjusted for site conditions. A field survey counting total traffic, heavy duty vehicles, school and transit buses, and motorcycles was conducted. The traffic mix on Rockville Pike was very close to the Appendix B mix, and the latter was used except for adjustment for the comparatively high volume of transit buses. In contrast, Cedar Lane and Jones Bridge Road have virtually no heavy duty truck traffic, and the vehicle mix using the MWCOG Appendix B mix as a base, was adjusted accordingly. Traffic departing NIH was 100 percent light duty vehicles.

Emission factors for individual road links accounting for soak distribution were computed in a post-modelling process. Vehicles on road links approaching the campus were assumed to have the MWCOG Appendix B or regional soak distribution. On those road links that contained both outgoing NIH and background traffic, a composite emission factor accounting for the proportions of NIH and Background traffic was computed.

In the CALQ3HC model, data and assumptions were:

- Applicable roadway and receptor coordinate geometry.
- Peak PM rush hour traffic from October 2003 surveys and 2023 projections for full Master Plan buildout conditions to determine the one-hour average CO concentrations.
- Existing intersection traffic signal cycle timing.
- The model was permitted to search for the wind direction that produces the highest CO concentration.
- Wind speed of 1 meter/sec.
- Atmospheric stability class D or 4.
- Maximum one and eight-hour CO concentrations (3.3 and 2.3 ppm, respectively) at the McLean Government Center monitoring station were used as background concentrations.
- Future background concentrations were estimated using the "rollback" technique, which accounts for reduction in vehicle emission rates and increase in regional vehicle miles of travel over time..
- Maximum eight hour concentrations were determined in a post process of the one hour modelling based on Appendix B data for regional hourly distribution of traffic on arterial roadways.

Predicted future "worst case" traffic generated CO concentrations are shown in Table 5-32. Predicted CO concentrations at both intersections are determined principally by emissions idling in queues at each signalized intersection. At the Cedar Lane intersection, all of the vehicle queues contribute to the total CO concentrations, although the northbound Rockville Pike queue is predominant.

At the Jones Bridge Road intersection, the worst case wind vector at this location also passes through the center of the intersection. Rockville Pike traffic contributes about two-thirds of the total CO in all cases due to higher traffic volumes.

Future traffic generated CO concentrations will be less than existing concentrations in all cases due to reduced vehicle emission rates. The one and eight-hour average NAAQS CO concentrations will not be exceeded and no impacts are expected.

Year/Case		Maximum CO Concentrations			
		Site 1		Site 2	
		One-hour Average	Eight-hour Average	One-hour Average	Eight-hour Average
2002 Existing	Traffic Background Total	1.8 <u>3.3</u> 5.1	1.4 <u>2.3</u> 3.7	1.2 <u>3.3</u> 4.5	0.7 <u>2.3</u> 3.0
2023 Master Plan	Traffic Background Total	3.0 <u>2.0</u> 5.0	2.4 <u>1.4</u> 3.8	1.8 <u>2.0</u> 3.8	1.4 <u>1.4</u> 2.8

TABLE 5-32 PREDICTED WORST CASE TRAFFIC CO CONCENTRATIONS.

5.6.2.2 Commercial Vehicle Inspection Facility

The proposed Commercial Vehicle Inspection Facility (CVIF) would be located on the east side of the campus adjacent to Rockville Pike between Wilson and North Drives. The peak number of vehicles arriving at the facility in the short term is expected to be 83 per hour based on a three day commercial traffic survey conducted at NIH in 2003. Peak volumes are projected to grow to about 105 vehicles per hour under full Master Plan buildout conditions.

The survey also classified arriving commercial vehicles into four categories: light vehicles, and heavy two, three, and four axle trucks. About 46 percent of the traffic is "light duty" vehicles for air quality analysis purposes with the remaining 54 percent classified as heavy duty vehicles, i.e. those with gross vehicle weights over 8,500 lbs.

Emission factors for the vehicles using the facility were determined by using the EPA MOBILE6.2, Mobile Source Emission Factor Computer Model. Base input assumptions were the same as those given in Section 5.6.2.1, except for vehicle mix. The Montgomery County local area vehicle mix distribution used in regional air quality conformity analysis was used as a basis for the facility vehicle mix distribution. The facility vehicle mix was determined by proportioning 45 percent of the facility traffic among the County light duty vehicle classes, and 54 percent of the facility traffic among the 16 County or MOBILE 6.2 heavy duty vehicle classifications. The latter include both diesel and gasoline fueled trucks.

The U.S. EPA CAL3QHC computer program for analysis of air quality at road intersections was used to model conditions in the vicinity of the CVIF. The program computes predicted carbon monoxide (CO) concentrations at specified receptor locations based on topographic, road, and receptor geometry traffic and its emission factors, and pollutant dispersion algorithms. The program has the capability of simulating emissions from vehicles idling in queues at signalized intersections.

The CVIF was simulated as a four lane approach road to a signalized intersection with the stop line at the front of the CVIF inspection area canopy. It was assumed that the fifth lane would be used only for a few vehicles pulled out of line for more thorough inspections. Each of the four lanes was modelled separately. The simulated "traffic signal" cycle for each lane was set to correspond with anticipated average inspection times. The red light time for light duty vehicles was set at 45 seconds, those for two

heavy duty vehicle lanes at two minutes, and one heavy duty vehicle lane at four minutes. Green time for all lanes was set at five seconds, simulating the release of only one or two vehicles at a time. The resultant average queue lengths ranged between five and six vehicles. Vehicles not idling moved at five miles per hour within the facility. The adjacent Rockville Pike/Wilson Lane intersection with its idling vehicles was included in the model. Although they do not occur concurrently, the traffic volumes associated with CVIF and Rockville Pike peak hour conditions were used in the model.

Only calendar year 2003 was modelled. By 2023, or full Master Plan buildout, CVIF traffic volumes will increase by about 26%, but overall vehicle emission factors will decline by about 50 percent.

There are no sensitive receptors in the vicinity of the CVIF. The CVIF building itself, and NIH Building 6A, the next closest building to the inspection facility at 380 feet distance from the inspection lanes, were selected as analysis sites.

Predicted peak one hour CO concentrations at the receptor sites are influenced by traffic at the Rockville Pike/Wilson Lane intersection as well as CVIF traffic. The total CO concentration at the north end of the CVIF building occurs when the wind is from the southeast (azimuth 160 degrees). Under these circumstances, the estimated CO concentration is 1.2 ppm with Rockville Pike traffic and CVIF idling vehicles contributing equally or 0.6 and 0.6 ppm, respectively.

The maximum effect of CVIF vehicles occurs when the wind blows from the east across the vehicles at the front of the queues at the stop line. In this case, the peak one hour average CO concentration is 1.4 ppm. CVI vehicles contribute 1.1 ppm, and Rockville Pike traffic contributes 0.3 ppm. The 1.1 ppm contribution from CVIF idling vehicles is constant all along the west side of the inspection area as long as all four inspection lanes are occupied when the wind is blowing from the east. The predicted 2003 total CO concentrations under these circumstances with background ambient concentrations included are:

	2003 One-Hour Average	2003 Eight-Hour Average
CVIF contribution	1.1 ppm	1.1 ppm
Rockville/Wilson contribution	0.3	0.2
Background	<u>3.3</u>	<u>2.3</u>
Total	4.7 ppm	3.6 ppm

Both results are well below the 35 ppm one hour average and 9 ppm eight hour average national standards.

The maximum CVIF vehicle contribution to a receptor at NIH Building 6A is 0.1 ppm, and no impacts are expected.

5.6.2.3 Parking

A “worst case” microscale analysis was conducted to determine the highest potential carbon monoxide (CO) concentrations generated by campus parking. CO concentrations produced by parking facilities at a given receiver site are directly proportional to the facility capacity, assuming all parking spaces are occupied, but decrease exponentially with the distance between vehicle source and receiver site. Worst case conditions occur under a combination of high vehicle count coupled with short distance between source and receiver.

It was determined that this occurs at multiple level parking structures MLP-6 and MLP-8, in the southwest corner of the campus (Figure 5-19). The two structures concentrate a large number of vehicles in a relatively small area. Their combined capacity is 2,531 spaces, about 26 percent of the campus total. The distance between MLP-6 and MLP-8 and nearby residences is 250 feet. MLP-6 and MLP-8 are existing structures and would continue in service under both the Master Plan and No Action Alternatives.

All other parking lots have, or will have, less air quality impact. Existing surface lots now in the north and south perimeter buffer are closer to nearby residential areas, but they have less than half the combined capacity of MLP-6 and MLP-8. They would also be removed under the Master Plan Alternative. The Master Plan Alternative proposes two new parking structures, MLP-10 and MLP-E, near the campus periphery, but they would be located interior to the perimeter buffer. Each would have less capacity and be at a greater distance to potential residential receivers than MLP-6 and MLP-8. For MLP-10, these values are 1,250 spaces and 360 feet; for MLP-E, they are 1,116 spaces and 400 feet.

The parking air analysis was completed using the CAL3QHC dispersion model. Emission factors were determined using MOBILE 6.2.

Basic assumptions used in the analysis were:

- MLP-6 has 880 parking spaces on 4 levels. First level at elevation 345 feet, and levels 10 feet apart in elevation. Spaces divided equally between levels. Exits at Levels 1 and 4. Vehicles use shortest route to exit.
- MLP-8 has 1,651 parking spaces on 7 levels. First level at elevation 325 feet, and levels 10 feet apart in elevation. Spaces divided equally between levels. Exits at Levels 1, and 3. Vehicles use shortest route to exit. About 75 percent of the spaces on Level 7 at the top are visitor spaces, the remainder are for NIH employees.
- From parking surveys at NIH, daily space turnover ratio is 1.4. Therefore, 1,232 daily exits from MLP-6 and 2,311 exits from MLP-8 occur.
- Based on a traffic and parking lot survey, hourly exits beginning at 10 AM were assumed as follows:

<u>Hour Beginning</u>	<u>MLP-6 Exits</u>	<u>MLP-8 Exits</u>
10:00 AM	88	165
11:00 AM	88	165
12:00 PM	88	165
1:00 PM	88	165
2:00 PM	88	165
3:00 PM	249	468
4:00 PM (peak Hour)	293	550
5:00 PM	249	468

Parking is saturated at NIH and the exit pattern is applicable for both 2002 and 2022.

- All departures from 10:00 AM to 3:00 PM start with an average 4-hour hot soak, those from 3:00 PM through 6:00 PM have an average 8-hour hot soak.
- All vehicles are light duty vehicles as defined in MOBILE 6-2, i.e. no heavy duty trucks. The vehicle mix among light duty vehicles was as defined by MWCOG for Montgomery County in the regional air quality conformity analysis.
- Vehicle departures are divided equally among the parking levels.
- Vehicle speeds in the garage are 5 mph.
- Emission factors determined for each parking level in each structure.

Meteorology is the same as for the traffic air quality analysis. The model was permitted to find the

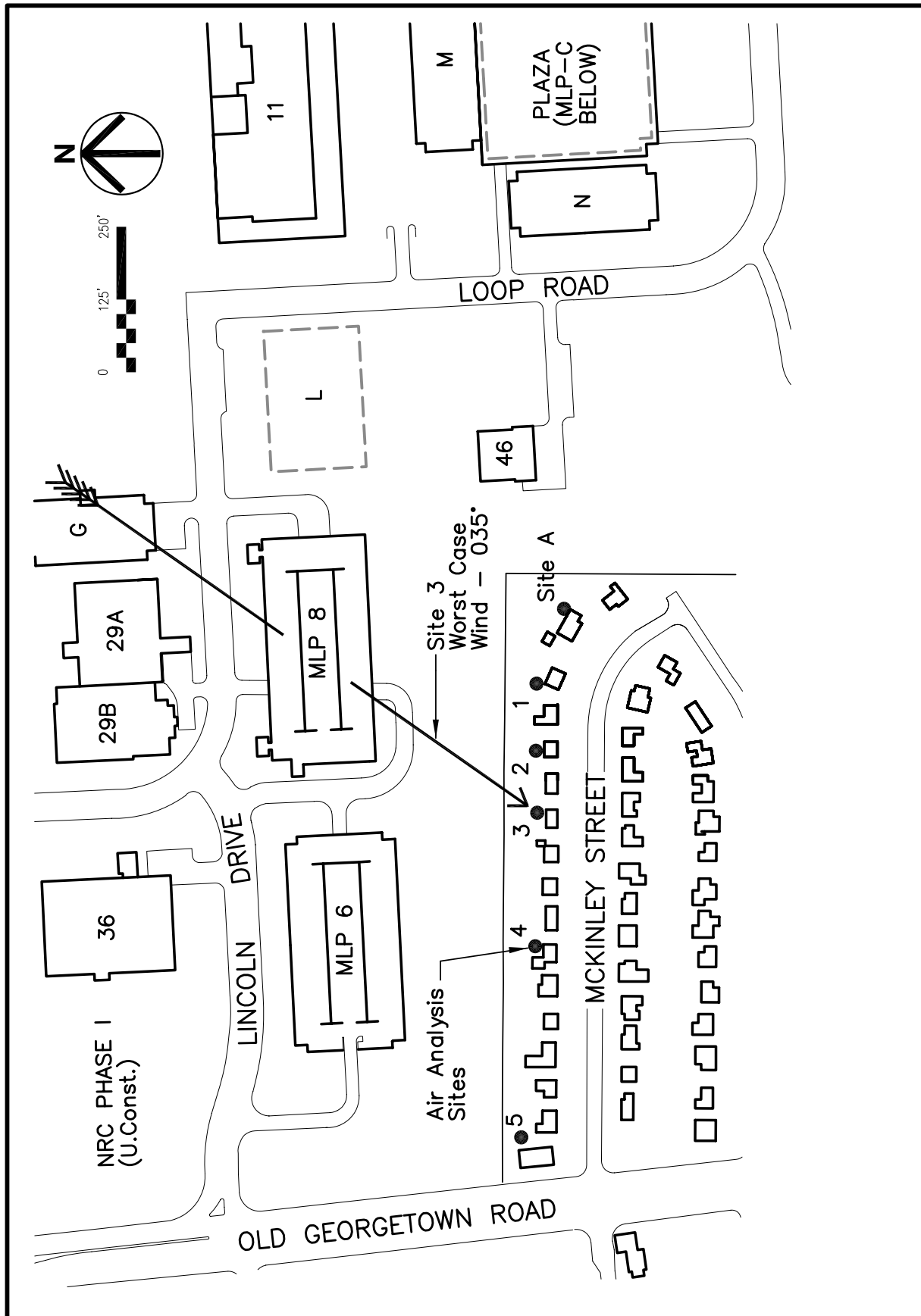


FIGURE 5-19 SITES FOR PARKING AIR QUALITY ANALYSIS.

- "worst case" wind.

Five sites were analyzed in the 1995 Master Plan EIS for the maximum or "worst case" one-hour average CO concentrations. It was determined that Site 3 was subject to the highest overall concentrations, and this updated analysis evaluated only that site. For a given year, predicted concentrations and impacts are the same for both the Master Plan and No Action Alternatives because MLP-6 and MLP-8 would be present in both alternatives. Both would operate at capacity in both alternatives because of campus parking demand.

Resultant estimated CO concentrations are shown in Table 5-33. Each parking level was modelled separately, as vehicle volumes increase progressively from top Level 7 down to a maximum on level 3, which has an exit. Volumes on Levels 1 and 2 are intermediate, but follow different patterns within the garage. Levels 3 and 4 contribute virtually all of the CO concentration at the receptor since they have both the highest traffic volumes and the least elevation differential with the receptor.

Future vehicle volumes and physical parameters remain the same under the Master Plan and No Action Alternative conditions as the MLP operates at capacity conditions in all cases. However, future MLP-8 generated CO concentrations will decline. This is solely due to U.S. EPA projected reductions in individual vehicle emission rates over time that are included in the MOBILE-6 model.

5.6.3 Stationary Source Air Quality

5.6.3.1 Central Steam Plant

The main point or stationary source for emissions on the campus is the central heating plant in Building 11. Existing Boilers 1 through 4 each have a capacity to generate 150,000 lbs/hr of steam. Boiler 5, which has a 200,000 lbs/hr capacity went into service in 1996. Total plant capacity is 600,000 lb/hr.

Prior to 1994, No. 6 fuel oil was used as the primary fuel supply. The estimated annual 1993 sulfur

	1-Hour Average	8-Hour Average
National/State Air Quality Standard	40,000	10,000
2002 EXISTING		
Parking	555	182
NIH Roads	400	275
Background	<u>3,900</u>	<u>2,700</u>
TOTAL	4,855	3,157
2023 MASTER PLAN and NO ACTION ALTERNATIVES		
Parking	166	85
NIH Roads	250	150
Background	<u>2,350</u>	<u>1,625</u>
TOTAL	2,766	1,860
EXISTING AND PROJECTED ONE AND EIGHT-HOUR AVERAGE CO CONCENTRATIONS AT SITE 3 (in $\mu\text{g}/\text{m}^3$).		

TABLE 5-33 WORST CASE PARKING CO CONCENTRATIONS (in $\mu\text{g}/\text{m}^3$).

dioxide and nitrogen oxides emissions using No. 6 fuel oil were 803 and 343 tons per year, respectively. In the mid-1990s, NIH implemented the first steps in the central heating and cooling plant modernization program. NIH retrofitted Boilers 1 through 4 for dual natural gas and No. 2 distillate fuel oil feed. Natural gas, which is a much cleaner burning fuel than oil, would be the primary fuel with No. 2 low sulfur content diesel oil used as a backup source. Boilers 1 through 4 were also retrofitted with low nitrogen oxides (NOx) burners, and flue gas recirculation emission controls to further cut nitrogen oxides emissions. Boiler 5 was installed with the new features. Emission reductions of 80 percent or more have been realized through the modernization program since 1993.

The PEPCO COGEN turbine and Heat Recovery Steam Generator (HRSG), Boiler 6, are expected to start service in 2004. The HRSG has a capacity of 108,000 lb/hr when it uses the exhaust heat from the turbine under standard daily operating conditions. An additional 72,000 lb/hr of steam can be produced through direct supplemental firing within the unit for a total capacity of 180,000 lb/hr.

Emissions from Boilers 1 through 5 are routed to a central stack, which encompasses the five individual stacks. Each individual stack is 40 inches in diameter. Stack height is 117 feet above ground level. The COGEN facility will have an independent 8-foot diameter stack that is 140 feet high.

Title V, Part 70, of the Clean Air Act Amendments of 1990 establishes a national program for permits for regulated air emission sources. For program purposes, NIH is classified as a major source because its overall emissions from fossil fuel fired equipment exceed regulatory threshold limits. NIH Title V permit 24-031-00324 describes all the regulated NIH emission sources, emission control equipment, operations, and compliance procedures. The Title V permit is applicable to Boilers 1 through 5, the COGEN facility, gasoline storage tanks, and emergency diesel generators with a capacity over 750 KW. The permit identifies applicable regulations for emissions, monitoring, and record keeping. As a permit condition, NIH conducts tests of stack emissions annually and files certification reports to MDE. The permit is renewable every five years. Although changes can occur in the interim, the permit is usually revised at renewal time to account for changes in conditions and regulations.

5.6.3.1.1 Annual NOx Emissions

The annual NOx emissions from the NIH central heating plant are limited to 55.6 tons for the COGEN unit and 81.7 tons for boilers 1 through 5, or a total 137.3 tons.

Heat is measured in British Thermal Units (BTU). When burned, natural gas and fuel oil release fixed amounts of heat, about 1,025 BTU/CF and 140,000 BTU/gallon, respectively. A fixed amount of heat is needed to generate a pound of steam. Compliance with the permit is ascertained by annual tests which determine a pollutant emission factor for each plant boiler in terms of pounds of pollutant per million BTU of fuel consumed (lb/mm BTU). This factor is multiplied by the annual fuel consumption of each type for each boiler as indicated in plant records to determine the aggregate or total plant pollution emissions for the year. The estimated NOx emissions in 2003 as derived by this method was 75.7 tons.

In practice, individual boiler pollutant emission factors vary from test to test, year to year. Emission factors, therefore, were computed using the procedures given in Compilation of Air Pollution Emission Factors, 5th Edition (US. EPA Publication AP-42), and 40 CFR 60, Appendix A (Table 5-34). Boilers 1 through 5 share the same emission and control characteristics, and resultant factor. The values for the COGEN unit are those given in the application for a permit to construct the unit, except for NOx when operating at 108,000 lb/hr. These latter factors (0.0442 and 0.1632) are based on value obtained during performance tests in 2003. The factors for future Boiler 7 are estimated on the basis that it will be a 200,000 lb/hr boiler with Reasonable Available Control Technology (RACT) FOR NOx emissions.

	Boilers 1-5		COGEN				Boiler 7	
			(1)		(2)			
	No. 2 Oil	Natural Gas	No. 2 Oil	Natural Gas	No. 2 Oil	Natural Gas	No. 2 Oil	Natural Gas
Carbon Monoxide (CO)	0.0779	0.0739	0.0248	0.0243	0.004	0.007	0.07796	0.0739
Sulfur Dioxide (SO ₂)	0.0507	0.0006	0.054	0.00066	0.054	0.00066	0.051	0.0006
Particulate Matter (PM10)	0.0143	0.0062	0.040	0.021	0.015	0.007	0.00929	0.00745
Volatile Organic Compounds (VOC)	0.00143	0.00278	0.0014	0.0014	0.002	0.003	0.00446	0.00423
Nitrogen Oxides (NOx)	0.130	0.050	0.1632	0.0442	0.120	0.120	0.10243	0.02427
(1) At 108,000 lb/hr and no supplemental HSRG firing.								
(2) At 180,000 lb/hr with supplemental HSRG firing.								

TABLE 5-34 EMISSION FACTORS FOR ESTIMATING BOILER PLANT POLLUTANT EMISSIONS (in lb of pollutant/mmbtu).

The use of these pollutant emission factors produces conservatively high emission estimates. Actual plant emission factors, as indicated by annual stack tests for Boiler 1 through 5, are generally less than the computed values.

Since the units have different pollutant emission factors for each type of fuel, actual or estimated emissions depend on which unit is used, and the amount of steam produced by each unit using each fuel type. Compliance to Title V NO_x emission limits under No Action and Master Plan Alternative build out conditions was assessed by development of simulated annual plant operations that would meet the projected steam demands given for each alternative in Section 5.4.1.2. Existing 2003 conditions were also simulated using the same procedures for comparison to actual operations and emissions.

Assumptions used in the operating scenarios are:

- Boilers 1 through 4 are interchangeable regarding pollutant emissions, i.e. any combination of these boilers may be used when the scenario indicates they are in service.
- Based on plant records, NIH generally operates the boilers between 50 and 75 percent of their capacity, except where peak demands dictate.
- Overall steam generation is split equally among the units within the previous parameter to meet demand.
- Plant efficiency for converting heat to steam is 85 percent.
- The COGEN unit is run 94 percent of the time (8,234 hours per year) based on the availability criteria in the NIH-PEPCO contract.
- For the Master Plan and No Action Alternatives, NIH will have a firm natural gas availability, not subject to curtailment, that will permit operation of the COGEN unit using this fuel throughout the year.
- Boiler 7 would not be installed under the No Action Alternative.
- Boilers 5 and 7 would be used equally on an annual basis in the Master Plan Alternative.
- That oil will be used in boilers for 20 days, or for 480 hours, per year due to curtailment under the No Action and Master Plan Alternatives, which are based on 2020 or later conditions.

The simulated annual plant operations for 2003 are summarized in the Table 5-35. Plant records were used to determine average seasonal steam demands. Natural gas is the preferential fuel because it

<u>Season</u>	<u>Demand PPH</u>	<u>Hours</u>	<u>Fuel</u>
Short Term Peak	585,000	1	Oil
Winter Oil Average	380,000	840	Oil
Winter Gas Average	314,500	1,320	Gas
Spring/Fall Average	190,000	4,392	Gas
Summer/Average	155,000	2,208	Gas

<u>Season</u>	<u>Boilers</u>	<u>% Capacity</u>	<u>MMBTU/hr</u>
Short Term Peak	1,2,3*	73	690
Winter Oil Average	1,2,3,4	63	448
Winter Gas Average	1,2,5*	63	371
Spring/Fall Average	1,2*	63	224
Summer Average	1,2*	52	183

* May be any combination of Boilers 1 or 2 or 3 or 4 where individual units are listed.

TABLE 5-35 BOILER SCENARIO FOR 2003 EMISSION ANALYSIS.

produces less NO_x and other pollutants per pound of steam generated. Oil is generally used when the gas supply is curtailed by Washington Gas, and demands outside NIH are high. Curtailment is also coincident with high campus steam demand. Gas was curtailed at least in part on 38 days (840 total hours) in 2003, and NIH used oil exclusively during these periods. Although oil was used for less than 10 percent of the year, nearly 17 percent of the annual steam production was generated using this fuel. The winter season was split into two parts when each type of fuel was used to account for this.

Boiler operating scenarios were developed for each seasonal condition. The short term peak condition is used in the analysis to estimate pollutant concentrations (see next section). The more complex future operating scenarios for the No Action and Master Plan Alternatives are shown in Tables 5-36, 5-37 and 5-38. The resultant existing and projected annual NO_x emissions based on given assumptions and operating scenarios are given in Table 5-39. The key assumptions are exclusive use of natural gas to fuel the COGEN unit, oil use in other units for 20 days and equal use of Boilers 5 and 7 throughout the year in the Master Plan Alternative projection. NO_x emissions would increase to an estimated 108.1 ton per year under the No Action Alternative, and to 123.9 tons per year under full build out Master Plan conditions. Master Plan emissions do not increase in proportion to steam demand because of the availability of Boiler 7. In this case, its NO_x emission factor is lower than the other units. The Title V operating permit NO_x limit would be met in both cases under the assumed conditions.

Actual emissions will vary from the projected estimates, either up or down, depending on several conditions. NIH will have some latitude in controlling overall annual emissions, particularly in the Master Plan case. Boiler 7 and the COGEN unit produce less NO_x than Boilers 1 through 5 per pound of steam produced. Maximization of the amount of steam generated by these units over the year would lower the annual amount of NO_x generated for a fixed steam demand.

Annual emissions are also dependent on the relative amounts of steam generated over the year using oil and gas. An analysis was made to determine the maximum number of days that oils could be used under Master Plan Alternative conditions. All the analytical assumptions and scenario conditions were

SCENARIO	CAMPUS STEAM DEMAND (KPPH)						
	NO ACTION 2008	MASTER PLAN (full implementation)					
Peak Hour	776	968					
Winter Oil Average	535	668					
Winter Gas Average	427	533					
Fall/Spring Average	252	314					
Summer Average	206	256					
ANNUAL OPERATING SCENARIO							
	NO ACTION ALTERNATIVE	MASTER PLAN ALTERNATIVE					
Season	COGEN Status (KPPH)	Oil Hours	Gas Hours	Total Demand (KPPH)	NONCOGEN Demand (KPPH)	Total Demand (KPPH)	NONCOGEN Demand (KPPH)
1 Winter	Oil	108	480	535	427	668	560
2 Winter	Gas	108	1,680	427	319	533	425
3 Fall/Spring	Gas	108	3,866	252	144	314	206
4 Fall/Spring	Gas	Off	526	252	252	314	314
5 Summer	Gas	108	2,208	206	98	256	148

Note: KPPH = 1,000 lbs/hr steam.

Note: KPPH = 1,000 lbs/hr steam.

TABLE 5-36 STEAM DEMAND SCENARIOS.

Scenario (boiler fuel)	Boilers	Operation at % Capacity	Steam Per Unit (KPPH)	Fuel Consumption (mmBTU/hr)
Peak Hour (oil) (not evaluated)	--	--	--	--
Winter (oil)	1,2,3 5	67 63	100 125	353 151
Winter (gas)	1,2 5	64 64	96 128	226 151
Spring/Fall/COGEN On (gas)	5	72	144	170
Spring/Fall/COGEN OFF (gas)	1 5	72 72	108 144	127 170
Summer	1	65	99	116

TABLE 5-37 PROJECTED NO ACTION ALTERNATIVE ANNUAL BOILER SCENARIO.

Scenario (boiler fuel)	Boilers	Operation at % Capacity	Steam Per Unit (KPPH)	Fuel Consumption (mmBTU/hr)
Peak Hour (oil)	1,2,3,4 5 COGEN 7	88 88 -- 88	132 176 108 176	623 208 241 208
Winter 20 coldest days (oil)	1,2,3 5 COGEN 7	66 66 -- 66	99 132 108 132	467 156 241 156
Winter 70 warmest days (gas)	1,2,3 5 or 7 COGEN	66 63 --	99 126 108	467 149 241
Spring/Fall/COGEN On (gas)	1,2 COGEN	69 --	103.5 108	244 241
Spring/Fall/COGEN OFF (gas)	1,2 5 or 7	63 63	94.5 126 144	244 149
Summer (gas)	COGEN 5 or 7	-- 74	108 148	241 174

TABLE 5-38 PROJECTED MASTER PLAN ANNUAL BOILER SCENARIO.

Scenario	Boilers	COGEN	Total
2003 Existing Actual	75.6	---	75.6
2003 Existing Computed	71.4	---	71.4
No Action Alternative	58.2	49.9	108.1
Master Plan Alternative	74.1	49.9	123.9
Title V Permit Limit	81.7	55.6	137.3

TABLE 5-39 ESTIMATED EXISTING AND PROJECTED ANNUAL NITROGEN OXIDES EMISSIONS (in tons per year).

maintained, except that fuel oil was used until the overall annual NO_x emissions reached the permit limit.

It is estimated that NIH would remain within the NO_x limit for an additional 15 days, or for the 35 coldest days of the year. This is based on 2003 outdoor temperature conditions. Additional oil use days could be accommodated by exclusive use of Boiler 7, when operating conditions require only one 200,000 lb/hr boiler in service to meet non-COGEN demand (see Table 5-34).

On the other hand, NIH now has three chillers with dual steam-electric drive. About 141,000 lb/hr of steam is required for all three units under steam operations. It is estimated that about 8.32 and 4.04 lb/hr of NO_x would be generated by Boilers 5 and 7, respectively, if each unit was used exclusively to drive chillers. Steam chiller drive is not included in the Table 5-36 totals.

Steam drive would be most effective during the summer months. Since the overall summer campus chilled water demand is higher, the chiller steam load would be uniform over time. Operation at 15,000 tons would reduce electric power consumption by an 8,850 KW HRS or KW necessary for electrical drive.

Most of the power delivered to the campus is generated in commercial power plants fueled by coal or oil. When burned, coal and oil produce higher amounts of NO_x than natural gas per BTU of heat generated.

Further, more than one kilowatt of power must be generated at the distant plant to delivery one kilowatt to the customer due to transmission line losses. NO_x emissions factors using bituminous coal can range from about 0.20 to 0.85 lbs/mmBTU depending on combustion unit characteristics, and emission controls. The entire range of emission factors for coal is far above those for natural gas.

Generation of electric power in the COGEN unit in effect, substitutes natural gas for coal and oil as the power generation fuel. On a regional basis, NO_x emissions are reduced by a factor of four or more for each KW generated by the NIH plant. Use of the power within NIH and the immediate neighborhood virtually eliminates distribution losses, and creates additional NO_x reductions. Driving the chillers using steam generated by the plant boilers also reduces regional emissions.

5.6.3.1.2 Emission Pollutant Concentrations

Computer stack plume dispersion modelling is used to estimate the atmospheric dispersion and resultant concentrations of pollutants at selected receptors in the vicinity of emission sources. Such an analysis was conducted as part of the 1995 Master Plan EIS by using the detailed Industrial Source Complex Short

Term (ISCST-2) computer model released by the U.S. EPA in 1992. The model revealed that there were no stack plume downwash problems created by proposed Master Plan buildings in quads located to the north and south of Building 11.

A screening level of approach using conservative assumptions and a “worst case” scenario was therefore used to update projections. The U.S. EPA recommended screening model, SCREEN 3, was employed. To conservatively calculate pollutant concentrations, a composite set of “worst case” conditions regarding meteorological conditions, aerodynamics, projected boiler emissions, and analytical assumptions were used.

U.S. EPA default options for meteorological conditions and building wake effects were used. The model uses a fixed internal set of meteorological parameters and computes potential receptor concentrations for 44 combinations of wind speed and atmospheric stability that may be experienced at any geographic location in the U.S. In some cases, the test cases are rare or are representative of very unusual meteorology that is not necessarily experienced throughout the U.S. Use of default values leads to conservatively high estimated concentrations.

The SCREEN 3 model also takes into account the potential influence of aerodynamic wake effects or downwash created by buildings in the vicinity of the stack source. Downwash tends to limit dispersion by drafting the plume to ground level at a point closer to the source before the effects of distance traveled are fully realized. The effects of Building 11 itself were modelled for potential downwash (90 feet high, 400 feet long, 223 feet wide) for existing conditions, and: 90 feet high, 515 feet long, and 251 feet wide for Master Plan conditions.

The base of stacks was set at reference elevation zero. Three receptor locations were analyzed:

1. The location where the COGEN stack emission produced a maximum concentration. This occurs on the campus at a distance of 337 feet from the stack. The nearest residence in the Glenwood neighborhood (Site A in Figure 5-19). The site distance and relative elevation above the stack base are 850 and 33 feet, respectively.
2. The uppermost floor at the Whitehall Condominiums, a high rise apartment building on the south side of the campus. The receptor is 1,865 feet distant from the stack at a relative elevation of 85 feet.

The SCREEN3 program computes maximum one hour concentrations. To estimate short-term, less than 24-hour concentrations, plant operations during the existing (585,000 lb/hr) and Master Plan build out (968,000 lb/hr) potential peak hour were modelled (see Tables 5-35 and 5-38). The No Action Alternative was not modelled, but would have results intermediate between existing and No Action conditions. It was assumed that all boilers would oil fired during the potential peak hour, and the COGEN unit, which is present only in the Master Plan case, would be gas-fired.

Boiler 1 through 5 have stacks located adjacent to one another in a three by two matrix manifold. Boiler 7, when built, will use the sixth stack. Each stack is 117 feet high and 40 inches in diameter. The COGEN stack is 100 feet distant from the center of the boiler matrix. Its height and diameter are 141 and 8 feet, respectively.

The COGEN stack temperature was set at 279° F and stack velocity at 67 ft/sec based on a combustion analysis. Values for the boilers were computed similarly, not only for the potential peak hour, but also average seasonal conditions. The SCREEN3 model was run with a unit stack emission rate of one/gram per second to obtain microgram/cubic meter per gram/sec factor for each receptor. In a past modelling analysis, for each pollutant, and for each operating boiler and the COGEN unit in the scenario, gm/sec emissions were determined by multiplying the appropriate operating unit pollutant emission factor (lb/mmBTU) by the heat throughput for the unit (mmBTU/hr), assuming 85 percent plant efficiency, and

making the appropriate engineering unit conversion. The resultant gm/sec values were multiplied by the SCREEN3 conversion factor to obtain µgm/cubic meter concentrations for each unit.

The U.S. EPA analytical procedure for merging stacks was modified to account for annual operations. The COGEN unit operates at a uniform rate throughout the year. As a result, only one or two boilers are operated during the non-heating season (March-November). The COGEN stack was used as the reference point. Boiler stacks were modelled as a single stack location with adjustments in distance made to the two residential sites. The contributions of each unit in service to the receptor site concentrations were summed to a cumulative total. This produces a conservative result that overestimates predicted pollutant concentrations, but ensures conformance to National Ambient Air Quality Standards (NAAQS).

U.S. EPA specified scaling factors were used to estimate short term pollutant concentrations applicable to longer NAAQS averaging periods. To obtain 3-hour, 8-hour, and 24-hour concentrations, the one hour model concentrations were multiplied by the EPA factors of 0.9, 0.7, and 0.4, respectively. Annual average pollutant concentrations were estimated by applying a factor of 0.1 to estimated concentrations derived by simulating plant operations over the entire year by season.

The resultant estimated receptor concentrations are shown in Table 5-40. Background concentrations are shown separately. Year 2022 Master Plan NO_x background concentrations have been adjusted in proportion to trend lines in the MDE 2002 Maryland Air Quality Report. Carbon monoxide background concentrations have been reduced using the “rollback” technique applied to traffic vehicle emission factors. The total existing and projected pollutant concentrations meet the NAAQS criteria in all cases

5.6.3.2 Laboratory Emissions

In contrast to vehicles or the boiler plant where emissions are limited to a few combustion products, laboratory emissions can have a multitude of potential components. These components and their concentrations vary from day to day depending on the collective experimental protocols that are underway. The pollutant emission volumes of any one researcher are small, since the amount of chemicals or biological materials handled at any one time is small. Quantities handled at any time are generally contained with beakers, phials and Petri dishes. Biological materials are generally tissue, DNA, or body fluid samples that are kept in refrigerators when not in active use. Until recently, although they would be locked at the discretion of the researcher, Biosafety Level 1 and 2 laboratories were otherwise accessible to anyone because there are no significant hazards.

Safe air quality levels must be maintained not only for the general public, outside the laboratory, but also the workers and visitors within the building itself. This is accomplished through national building and mechanical codes that set ventilation requirements. These requirements are used for the design and construction of university student and research laboratories and biomedical research facilities in the private sector throughout the U.S.

Since the amount and character of potential pollutant generation is variant, the codes are based on the principle of massive dilution. For biomedical laboratories, they call for 12 to 20 air changes per hour throughout the building. Ventilation air is therefore resident in the building for three to five minutes. Air is pulled through the building by large exhaust fans located in mechanical penthouses located on the roof and released to the atmosphere at that point.

To illustrate, new laboratory Building 50 has about 290,000 gsf of floor space. The floor to ceiling height in laboratory spaces is 12 feet. If the average number of air changes is 15 per hour, then about 52 million cubic feet of air is drawn through the building each hour.

POLLUTANT/ AVERAGING TIME		MAXIMUM			SITE A			APARTMENTS			NAAQS
		PLUME	BACK GROUND	TOTAL	PLUME	BACK GROUND	TOTAL	PLUME	BACK GROUND	TOTAL	
EXISTING											
CO	1-hour	312	3,900	4,212	152	3,900	4,052	202	3,900	4,102	40,000
	8-hour	218	2,700	2,918	107	2,700	2,807	141	2,700	2,841	10,000
SO ₂	3-hour	183	86	269	89	86	175	118	86	204	1,300
	24-hour	81	47	128	40	47	87	52	47	98	365
	Annual	1.4	18	19.4	0.7	18	18.7	1.0	18	19	80
NO ₂ as NO _x	Annual	10	38	48	5	38	43	7	38	45	100
PM ₁₀	24-hour	23	45	68	11	45	56	15	45	60	150
	Annual	1.2	18	19.2	0.6	18	18.6	0.9	18	18.9	50
2022 MASTER PLAN											
CO	1-hour	459	2,350	2,809	204	2,350	2,554	234	2,350	2,584	40,000
	8-hour	321	1,625	1,946	143	1,625	1,768	164	1,625	1,789	10,000
SO ₂	3-hour	233	86	319	105	86	191	128	86	214	1,300
	24-hour	103	47	150	47	47	94	57	47	104	365
	Annual	1.3	18	19.3	0.6	18	18.6	0.8 8	18	18.8	80
NO ₂ as NO _x	Annual	14	28	42	6	28	34		28	36	100
PM ₁₀	24-hour	35	45	80	15	45	60	17	48	62	150
	Annual	2.9	18	20.9	1.3	18	19.3	1.3	18	19.3	50

TABLE 5-40 EXISTING AND PROJECTED MASTER PLAN BOILER PLANT AIR QUALITY CONCENTRATIONS. (in micrograms per cubic meter)

Further dilution occurs once roof top emissions are released due to atmospheric dispersion in both the horizontal and vertical direction. The magnitude of this dispersion is several million fold. As a parallel example, it is estimated that traffic on Rockville Pike, Old Georgetown Road, and West Cedar Lane produces about six tons of carbon monoxide per day solely on those links adjacent to the campus. But the contribution of this traffic to the carbon monoxide at residences adjacent to the roadways is measured in terms of a few parts per million (ppm), or micrograms per cubic meter.

Further operational and ventilation requirements are set for Biosafety Level 3 and 4 laboratories. If necessary, experimental work is done in sealed chambers with built-in hand access that are within the laboratory room. Codes and standards require the laboratory room to be kept at a “negative” or lower air pressure in relation to the building as a whole to contain any release of material to the room itself. The codes also require all air exhausted from Biosafety Level 3 and 4 laboratories to pass through High Efficiency Particulate Arresting (HEPA) air filters before release. These special filters, originally developed by the military over 50 years ago, remove particles down to the 0.1 micron level. Materials removed include microdust, smoke, spores, bacteria, and viruses.

5.7 WASTE

Waste generated at NIH are classified by Federal and State regulations which define procedures for waste handling, treatment, storage, transport, and disposal. In some cases, NIH has defined classifications for management of waste within NIH to ensure that waste are handled within the Federal and State regulatory framework. Classifications of waste generated at NIH include solid or general waste, medical/pathological waste (MPW), radioactive waste, chemical waste, and multihazard/mixed waste.

5.7.1 Solid or General Waste

Solid waste is general waste as defined by 40 C.F.R. §243.101 and 40 C.F.R. §257.2. Solid waste consists of general trash, garbage, and refuse. At NIH, solid waste includes office waste; disposable paper products, plastic, glass and wood; animal bedding which is not contaminated; cafeteria or dining center waste; and a small amount of residential trash, all of which are classified as general waste.

Solid waste also includes yard waste and waste from campus maintenance and construction. As in private commercial spaces, interiors of buildings are renovated, refitted, and rearranged to suit the changing needs of occupants. These alterations are occurring around the campus on a continuing basis. Materials can include partitions, doors, glass, and office furniture.

General waste is collected by custodial staff and placed in about 60 dumpsters located throughout the campus. Yard and construction waste are handled separately. A private contractor collects the waste and hauls it to the Montgomery County Transfer Station where a tipping fee is paid to the County on a pass through basis. About 8 to 12 truckloads per weekday are hauled to the transfer station.

NIH is the largest federal employer in Montgomery County and the largest single source of solid waste from among the civilian federal agencies, which contribute less than 3% of the total waste generated in the County. In 2003, campus facilities generated 11,879 metric tons of solid waste (Table 5-41). More than half of the total campus general waste originates in the Clinical Center, or Building 10.

Recycling consists of recovering materials before they enter the waste stream, and diverting them from landfill disposal to reuse as raw materials for the manufacture of new products. For many years, NIH has participated in GSA surplus property programs to recycle paper, scrap metal and used furniture and equipment. Since 1996, an even more concentrated effort to incorporate recycling within waste

CALENDAR YEAR					
SOLID WASTE GENERATION	1999	2000	2001	2002	2003
General Waste	9,631	10,021	10,431	9,880	9,644
Yard Waste	<u>37</u>	<u>105</u>	<u>1,155</u>	<u>1,023</u>	<u>215</u>
Subtotal - General + Yard	9,668	10,126	11,586		9,859
Construction Waste	<u>3,230</u>	<u>2,434</u>	<u>1,278</u>	<u>873</u>	<u>2,020</u>
Total Solid Waste	12,898	12,560	12,864	11,776	11,879
RECYCLED MATERIALS					
White Office Paper	395	375	364	405	357
Mixed Paper	147	222	222	220	238
Mixed Paper Shredded	--	--	--	--	749
Wood Pallets	245	284	186	238	325
Baled Cardboard	340	364	387	440	501
Co-mingle	45	46	50	51	48
Scrap Metals - general	889	585	331	323	220
Polypropylene	13	34	28	79	57
Electronic Equipment (estimated)	--	--	--	--	135
Aluminum Cans	6	6	9	9	10
Batteries	*	*	1	4	15
Toner Cartridges	*	*	*	*	<u>2</u>
Total General Waste Recycled*	2,080	1,916	1,578	1,769	2,657
% General + Yard Waste Recycled	21.6	19.1	15.1	17.9	27.6
General + Yard Waste Recycled	7,551	8,105	8,853	8,111	6,987
% General + Yard Waste Recycled	21.9	20.0	23.6	25.6	29.1
General + Yard Waste Recycled	2,117	2,021	2,733	2,792	2,872
* Less than one ton.					

TABLE 5-41 SOLID WASTE GENERATION AND RECYCLING. (in tons).

management services contracts has been instrumental in increasing recycling and recovery activities. Several programs have been adopted to reduce net solid waste generation through waste generation reduction and increased recycling and recovery activities. White office paper is collected from major office buildings through a White Office Paper Recovery Program (WOPR) and sent to recycling outlets under general and waste management contracts. Mixed paper, which is composed of newspaper and all paper meeting white office paper criteria, is handled under the logistics system, staged in a central campus location and removed bi-weekly by a local recycling company.

Scrap metal, which includes light iron, laboratory refrigerators with the freon removed, and other miscellaneous recoverable materials, are recycled. Scrap metal from alterations performed by the NIH, Shops Branch, as well as from the property management system are sent to a metal reclamation facility.

Wood pallets are also collected by work crews and sent to a pallet recycling center. NIH has started programs to recycle styrofoam materials generated in campus dining centers, purchased balers for

consolidating and compacting cardboard generated in certain areas within the Clinical Center, and organized several Recycling Action Teams (RAT). The teams have established recycling programs tailored to each building, and are educating employees to identify and recover materials in the waste originating in the NIH shops and buildings.

Waste streams, which have been added to 1995 recycling efforts, include the recovery of co-mingled waste, polypropylene laboratory and cafeteria containers, batteries, and electronics that include laboratory equipment and personal computers. Co-mingled recycled material, defined for contractual purposes, comprises steel cans, glass, beverage containers, and two types of plastics.

NIH also recycles yard waste consisting of grass clippings and tree pruning trimmings. The annual amount varies considerably, but appears to consist of a base 40 to 45 tons of grass, leaves, and ground landscaping materials. The unusually high amounts in 2001 and 2002 are due to a comprehensive periodic campuswide tree maintenance program that removed dead trees, and pruned all mature trees.

The amount of solid waste generated at NIH has remained relatively constant since 1992 despite an increase in campus population from about 16,300 to 17,500. The 10-year average solid waste generation since 1992 is 12,582 tons and yearly values are generally within ten percent of the average. Annual variance is due to the nature of continually changing research and support operations. The initiation or end of a research project, or the number of laboratory renovations or alterations can influence the amount generated in a given year. Although no trend has been established with increase in campus population since 1995, some increase in generation can be expected as the population increases from 18,000 to 22,000 in 2020. Recent experience does indicate, however, that the growth in solid waste generation is not necessarily directly proportional to population growth. The amounts of total solid waste generated in 2002 and 2003 were the lowest since 1991, and are the result of recent concentrated efforts to minimize waste generation of all types.

Recycling amounts since 1995 have more than tripled. NIH Bethesda recycled 704 tons of solid waste in FY 1992, the first year of accelerated efforts to do so. Recycling comprised 5.4 percent of the total generated. Most of the recycled material was mixed and white office paper. By 2003, NIH had increased its recycled amounts to 2,657 tons of general waste alone, or 27.6 percent of the total. Even higher amounts and percentages had been recovered in the previous year. These recycling amounts and percentages do not include recycled yard and construction waste. When groundskeeping waste is added, the respective values were 2,872 tons and 29.1 percent. The tonnage of general waste to disposal in 2003 was the lowest annual value since at least 1988.

Projected long term estimates for recycling are difficult to make. Since NIH has many types of waste streams in the laboratory environment, it must be cautious in applying an aggressive approach to solid waste recycling in these work areas. After the initial stages of waste minimization and recycling programs, incremental gains in waste reduction and amounts of materials to recycle and recover are more difficult to achieve and are smaller in scope. Realistically, in the long term, it is estimated that NIH may be able to recycle about 25 percent of the solid or general waste material generated on the campus.

Montgomery County has one of the highest per capita waste generation rates in the U.S. All burnable solid waste is hauled to the County Resource Recovery Facility near Dickerson, Maryland. Ash from that facility, and non-processable waste is hauled by rail and truck to a landfill in Brunswick County, Virginia. This facility will accept Montgomery County waste under a contractual agreement through 2012. NIH solid waste have negligible or no impacts on the Montgomery County system according to the Montgomery County Office of Solid Waste Management.

The initial Montgomery County Ten Year Solid Waste Plan established a goal of 35 percent recycling by

1995 and 50 percent by 2000. The County currently recycles more than 35 percent of its waste. The County had an interim goal of achieving 45 percent recycling by the end of 2002. It is now expected that the 50 percent goal will be reached sometime between 2004 and 2006.

Projections for solid waste generation and recycling cannot be made with precision. In most years, future yard waste generation should fall between 40 and 50 tons. But, it will spike in individual years, if NIH has a periodic tree maintenance and pruning project underway, or if there is extensive tree storm damage. Construction wastes will also have a wide variance, depending on the number and character of projects underway. Particularly high values will occur in those years when buildings are demolished or undergoing renovation.

5.7.2 Biomedical Research Waste

There are approximately 3,000 laboratory bench spaces for researchers on the campus. Biomedical research experiments generally involve test tube, vial, beaker, and small bottle quantities of materials. The effects of an experiment may be evident only under the microscope or through microbiological technology. Researchers may work meticulously for days or weeks to generate a teaspoonful or less of working material. The amounts of materials used in any one experiment are therefore generally small. A container with five gallons of chemicals or waste is considered to be a large amount. Waste related to biomedical research are generated in the Clinical Center hospital and all laboratories.

As a world leader in biomedical research, NIH expects its waste management program to be exemplary. According to NIH policy and manuals, all waste types are generated, identified, handled, packaged, collected, transported, treated and disposed of in a manner that protects employee and public health and safety, assures compliance with environmental regulations and permits, and promotes the effective use of resources.

NIH stringently controls waste generated by biomedical research. The NIH Divisions of Environmental Protection (DEP) and Radiation Safety (DRS) are responsible for all aspects regarding the safe use of materials and the management of waste, including the training of personnel in these areas. Waste is managed from "cradle to grave", i.e. from generation to ultimate disposal. All nonradioactive waste is managed by the Waste Resource and Recovery Branch (WRRB) within the DEP. Similarly, DRS is responsible for the management of radioactive materials and waste.

NIH has professionals in health and safety, who inspect and monitor laboratory and Clinical Center facilities, and advise and train researchers in laboratory and experimental safety on a full time basis. Of these, about 35 are specialists in radiation health and safety. These personnel inspect all facilities where radioactive materials are handled or stored, on at least a quarterly or semi-annual basis, to ensure safe use of the materials.

All NIH personnel involved in the handling, transport, and use of radioactive materials are trained in accordance with NRC requirements. Only after passing the training course examination are they authorized to handle or use radioactive materials by NIH. Such employees attend one class immediately after employment, and are required to complete refresher training once every two years. Training emphasizes radioactive material waste minimization through the use of less radioactive nuclides, lower volumes of materials used in experimentation, and delineating alternatives that do not involve radioactive materials.

The DEP and DRS act as central repositories of information for all Institute researchers in handling materials and on waste management technology and regulations. In many cases, procedures developed at

NIH are used throughout the biomedical research community. These include Laboratory Safety at NIH, Working Safely with HIV and other Blood Borne Pathogens in the Research Laboratory, NIH Chemical Hygiene Plan, NIH Radiation Safety Guide, NIH Hazard Communication Program, Management of Chemical and Mixed Waste at the NIH, and Waste Disposal. The last gives summary guidance in calendar form. These documents are reviewed and updated frequently in response to changing conditions and regulatory requirements. Advisory services in the DEP, DRS, and Occupational Safety and Health Division are available to the researcher in developing experimental and waste minimization protocols.

Chemical, radioactive, and multihazard/mixed waste management operations are run on a turn key basis by specially trained and qualified private contractors. Chemical waste is handled from laboratory pickup to ultimate disposal by the NIH Chemical Recycling and Disposal Service (CRDS). Radioactive waste are handled in the same manner under the same contract by the NIH Radioactive Waste Service (RWS). Contractor personnel are qualified professionals in the handling, packaging, storing, transporting, and disposing of chemical, multihazard, mixed, and radioactive waste as well as applicable spill prevention and control measures.

Emphasis is placed on waste generation minimization at NIH. Management begins at the source of waste. Waste minimization is an integral part of each experimental protocol. Experiments are designed so that reagents and procedures that will reduce or eliminate hazardous waste are selected. Minimum chemical procurements are planned and made to avoid waste created by outdated and unused stock and to minimize storage requirements and hazards. When possible, less hazardous or nonhazardous materials are substituted. If a hazardous waste is generated, procedures that may reduce the volume of that waste are applied.

If the waste chemical from one experiment is a desirable stock chemical in another, it may be exchanged within the NIH laboratories. Prior to their designation as waste, certain materials may be treated, separated, neutralized or inactivated in the laboratory to reduce toxicity, hazard, or volume. Infectious agents, for example, may be deactivated by autoclaving or applying a disinfectant to convert a multihazard waste to a simple chemical or waste.

Waste are strictly segregated in the laboratory to avoid creating unnecessary amounts of multihazard/mixed waste. Aqueous and organic solvents, liquid and solid waste, and short and long half life radioactive materials are kept separate. A wide assortment of appropriate waste containers, many defined and specified by Federal and State regulations, are provided to researchers by the appropriate waste management groups within the DEP and DRS. The researcher labels the container for date, source, constituents, and potential hazard. Accumulated waste are stored temporarily in cabinets or in secure areas in the laboratories away from general public and easy employee access.

For chemical, radioactive, and multihazard/mixed waste, CRDS or RWS contractor personnel inspect the waste, and researcher packaging and labeling, remove the waste, and transport them to Building 21. These waste are picked up within 24 hours after the researcher calls for a pickup. If waste are generated cumulatively in an experiment over time, waste are picked up when containers are no more than three-fourths full, or at a maximum duration of sixty days from the first generation regardless of the accumulated amount.

At Building 21, chemical, radioactive, and multihazard/mixed waste are segregated by different regulatory categories. If there is doubt, waste are analyzed for content, pH, and other characteristics to ensure proper classification, handling, treatment, storage, transport, and disposal. If necessary, waste are treated to render them nonhazardous, reduce hazard, reduce volume, or convert multihazard or mixed waste to a single classification. Waste may be bulked by consolidation of compatible waste from the

multiple small containers produced in the laboratory to a single container or fewer containers for subsequent shipment.

Waste are then shipped weekly by the CRDS and RWS to off site management facilities. Off site transport is manifested under applicable regulations. Ultimate disposal sites, licensed or approved by Federal or State agencies, depending on material and hazard involved, are reviewed and may be inspected by NIH. In general, all distribution, disposal, and recycling of waste occurs at off site facilities where sufficient quantities accrue to make recycling economical, or where special equipment is available. When waste are disposed of, NIH keeps a permanent certificate of disposal record.

5.7.2.1 Medical Pathological Waste (MPW)

Medical waste generation is ubiquitous in modern society. It is routinely generated at all hospitals, in private medical testing and biomedical research laboratories, and dentist and doctor offices. Medical waste generated by these sources generally are either incinerated on-site at the source or transported to off site locations for disposal. For smaller generators, contractors follow established pick-up routes and schedules in the same manner as municipal trash collectors.

Procedures for handling, treatment, storage, and disposal of medical waste are controlled by Federal and State regulations. Each defines the waste differently and gives minor variances in procedures. Pertinent regulations include EPA regulations for "regulated medical waste" in 40 C.F.R. Part 259, OSHA regulations for waste containing "bloodborne pathogens" in 29 C.F.R. §1910.1030, and State of Maryland regulations for "special medical waste" in COMAR 10.06.06, 26.13.12, and 26.13.13. Transport of medical waste is controlled by U.S. DOT regulations in 49 C.F.R. Part 171 and State regulations. To ensure compliance, NIH has merged the definitions and requirements of the various regulations into a single classification, medical pathological waste (MPW), for internal NIH use. This unification simplifies employee understanding of requirements, and in meeting NIH procedures for MPW, the employee satisfies all the Federal and State regulations.

MPW is defined as waste that because of actual, or perceived presence of pathogenic agents, requires containment or treatment to prevent occupational or environmental exposure. Pathogenic agents are bacteria, viruses, or other organisms that can cause diseases. Examples of MPW include microbiological cultures; clinical urine, fecal and blood specimens; tissue cultures; waste from surgical and autopsy suites; contaminated animal bedding; and "sharps". Sharps include needles, syringes, scalpels, razor blades and similar objects. Disposable clothing, paper towels, and sorbent materials contaminated or potentially contaminated with pathogenic agents are also classified as MPW.

At NIH, MPW is packaged at the point of generation according to established procedures. It is sealed inside two thick opaque bags, and then packed in cardboard containers referred to as "MPW Boxes". Sharps are placed intact in puncture resistant plastic containers, before packing in the outer MPW Box.

Boxes are labeled for source and content and sent to designated pick-up locations inside buildings around the campus. MPW is stored under refrigeration at each of these designated locations. MPW is then picked up, inspected for potential radioactivity in Building 21, and marshalled in Building 25 for subsequent transport to off-site disposal. If radioactivity is found, the MPW is handled as radioactive waste, or treated until classifiable as MPW alone.

Data on recent MPW generation is shown in Table 5-42. The amounts generated include about 40 tons of MPW generated at the NIH Animal Center in Poolesville each year and transported to the campus. About

<u>Fiscal Year</u>	<u>Metric Tons</u>
1999	1,014
2000	1,031
2001	1,018
2002	1,090
2003	1,040
FY 89 - FY 93 Average	1,895
FY 94 - FY 98 Average	1,262
FY 99 - FY 03 Average	1,039

TABLE 5-42 MEDICAL/PATHOLOGICAL WASTE GENERATION.

70 percent of the MPW is generated in the Clinical Research Center and is hospital related.

In Fiscal Year 1994, NIH established a rigorous MPW minimization program that included employee and researcher training on MPW source reduction, management of materials and waste, and identification, packaging, and labeling of MPW. In the five years previous to FY 1994, NIH had generated MPW at an annual average rate of 1,895 tons. As a result of the program, a steady decline in generation has been realized. The annual average amount produced in FY 1994 through FY 1998 was about 1,200 tons a 33 percent reduction from levels prior to the initiation of the minimization program. Through further aggressive minimization programs, annual generation has fallen to nearly 1,000 tons in the last five years of record, or about 45 percent of pre-1994 levels. All of this has occurred while the number of researchers on campus has increased.

NIH intends to continue with the minimization program and further reductions per worker are possible. The initial program reductions are the easiest and largest. Future reductions will occur in smaller increments. It is expected that future MPW generation will be of the same order of magnitude or slightly less per worker. Since the new Clinical Center hospital will have fewer beds than the existing one, and the hospital accounts for about 70 percent of MPW generation, generation from this source can be anticipated to decline. Conservatively, it is anticipated that future MPW generation under the Master Plan will remain relative constant or decline slightly, although specific estimates cannot be given. Generation under the No Action Alternative would also continue to decline. Under the Master Plan Alternative, the campus MPW marshalling facility now in Building 25 on the south side of Building 11 would be relocated to the Building 21 area.

5.7.2.2 Radioactive Waste

NIH is licensed by the U.S. Nuclear Regulatory Commission (NRC) to use, store, and dispose of radioactive materials. The license sets maximum possession limits for various radionuclides, as well as the conditions governing their use, storage and disposal. Activities involving radioactive material are strictly controlled by the NRC through regulations, which can be found in 10 C.F.R. Parts 19, 20, 30 and 35, and others. The NRC inspects all NIH facilities for compliance with the regulations on a regular basis. Applicable regulations of the U.S. DOT (49 CFR Part 171) and U.S. EPA (40 CFR Part 60) also apply.

Examples of radioactive waste generated by NIH's biomedical research activities include contaminated paper, plastics and glassware, radioactive liquids, liquid scintillation counting fluids and vials, contaminated experimental or cleanup materials, and contaminated medical pathological waste, including patient care waste.

Nearly all radioactive material used at NIH involves quantities of very low levels of radioactivity. Materials are generally in the form of labeled proteins and compounds. Examples of radioactive materials used are Hydrogen-3 (tritium), Carbon-14, Sulfur-35, and Phosphorous-32. Most of the radioactive materials used on the campus, with the exception of C-14 and H-3, have a half-life of less than 100 days.

Building 21 has laboratories designated for the use of radioactive materials with quantities of radioactivity higher than typically used in a standard laboratory. These laboratories have restricted access, increased air circulation with filtration, and stringent contamination survey and control procedures.

Radioactive waste are sorted by physical form, chemical form, and half-life, if appropriate. Some radioactive waste that are contaminated with materials that have a short half-life (<100 days) may be stored until they are no longer radioactive, and only then disposed of as non-radioactive waste.

Some radioactive waste are treated and processed in Building 21. Waste, which are not treated or processed on-site, are shipped to a licensed commercial processing facilities and eventually to a disposal facility. NIH is licensed to dispose of limited quantities of liquid radioactive waste to the sanitary sewer, with specific concentration limits for each isotope and a total aggregate limit per year. In general, the concentrations of released materials are less than one percent of the permissible concentrations under the regulations, and the total aggregate amount released for the year are significantly less than the permit aggregate total. Further dilution occurs within the NIH sanitary sewer system where the radioactive materials combine with nearly two million gallons of sanitary waste generated by NIH per day. All aqueous radioactive waste disposed in the sanitary system must meet all other WSSC discharge criteria (See Table 5-25). Prior to release, materials are filtered to remove suspended solids, and treated with activated carbon to remove organic contaminants. Before each release occurs, WSSC is notified, and WSSC may have an inspector on the scene to observe the release.

At one time, NIH maintained a facility for dry low level radioactive waste at the NIH Animal Center in Poolesville, Maryland because there was no outside permanent licensed radioactive waste facility operating in the U.S. Such facilities are now available and the Poolesville site has been deactivated and closed. All waste that still has radioactivity after treatment in Building 21, is now hauled by licensed contractors to licensed treatment or disposal facilities at eight off-site locations.

The amount of radioactive waste generated by NIH varies considerably from year to year depending on whether or not individual research projects use radioactive materials and the amounts they use (Table 5-43). NIH initiated a rigorous radioactive waste minimization program in Fiscal Year 1998. Proposed research protocols are reviewed for alternatives to methods requiring radioactive materials, and when they are necessary, their absolute minimization. Prior to the program, NIH Bethesda generated an average 399 tons of radioactive waste per year from 1989 through 1997. The annual generation over the last five years has averaged 105 tons, a 74 percent reduction from pre-program levels.

Future generation is difficult to estimate. However, waste and researcher organizations predict a long term trend for lower use of radioactive materials in medical treatments and biomedical research.

NIH also operates three cyclotrons in the Building 10. The cyclotrons produce radioactive isotopes, which are valuable for medical diagnosis, with half-lives measured in terms of minutes or hours that are too short to effectively transport them from an off-campus location. An example is oxygen 15 with a half-life of 2.03 minutes. Prepared materials are, therefore, immediately applied to patients in Clinical Center suites above the cyclotron facility. Decay is so rapid that the cyclotron-generated radioactive materials are disposable as non-radioactive or other types of waste within hours or a few days. In effect, the cyclotrons generate radioactive materials, but produce no long term radioactive waste for treatment or

<u>Fiscal Year</u>	<u>Tons</u>
1999	78
2000	154
2001	85
2002	116
2003	92
FY 89 - FY 97 Average	399

TABLE 5-43 RADIOACTIVE WASTE GENERATION. (in tons)

off-campus disposal.

5.7.2.3 Chemical, Multihazardous/Mixed Waste

Chemical waste are discarded non-radioactive chemicals, including hazardous and nonhazardous chemicals. Chemical waste includes items defined as Hazardous Waste (40 C.F.R. 261), Hazardous Substances (40 C.F.R. 302.4), Hazardous Materials (49 C.F.R. 171.8), and Controlled Hazardous Substances (26 COMAR 13.02.06). Chemical waste that are not regulated under Federal or State regulations as hazardous, but which have toxic or hazardous waste characteristics, are considered to be hazardous waste by NIH. Nonhazardous chemical waste include nonradioactive chemicals that are not regulated by any government agency as a hazardous waste. Example of nonhazardous waste frequently encountered at NIH include most salts; sugars; agar; enzymes and nutrients used to formulate culture media; saline solutions; and silica and polyacrylamide gels. Most of the chemical waste at NIH consists of used, spent, or surplus chemicals. Data for chemical waste generation in recent years is as follows:

Fiscal Year	Metric Tons
1999	157
2000	143
2001	194
2002	254
2003	193

Chemical waste generation for the last 15 years follows no particular pattern. The average annual amount for this period is 192 tons, but ranges from 143 to 318 tons per year depending on individual and collective research programs that are underway at any given time.

Some reductions per research worker are expected due to two predicted long term biomedical research trends. The first trend is greater use of computers as a substitute for bench research protocols. The computing power of personal computers has increased by several orders of magnitude over the last decade. Much of the research involving DNA and genetics can be done more efficiently on a computational basis. The second trend is greater use of miniaturization techniques in research protocols to control costs. Researches must compete for NIH grants in terms of potential results and costs. The amount of chemicals needed and the waste produced are directly proportional to costs.

Multihazard waste is an NIH definition for a waste that meets the definition and properties of more than one of the restricted waste, which are MPW, radioactive waste, and chemical waste. Mixed waste is a combined chemical and radioactive waste and is therefore a subset of multihazard waste.

Examples of multihazard waste are aqueous radioactive waste with trace levels of chloroform or heavy metals; radioactive methanol/acetic acid solutions from protein precipitations; phenol/chloroform mixtures used to extract DNA from radioactively labeled cells; and chemical or radioactive waste containing blood products.

Amounts of multihazard/mixed waste are included within the chemical and radioactive waste totals. Prior to 1987, NIH conducted its hazardous waste activities under an "interim status" hazardous waste facility authorization from the U.S. Environmental Protection Agency. Since that year, NIH has managed hazardous waste under terms and conditions established by an agreement with the Maryland Department of the Environment (MDE). NIH has a Resource Conservation and Recovery Act (RCRA) hazardous waste management facility operating permit. The permit allows NIH to continue to:

1. Provide short term storage of hazardous materials in approved containment until disposal or preliminary treatment can be arranged.
2. Chemically and physically treat hazardous waste to render it non-hazardous, reduce hazard, or reduce volume.
3. Provide longer term storage of hazardous waste (mixed waste) for which off-site disposal or treatment is currently unavailable.
4. Receive hazardous waste from off-campus NIH facilities for treatment and storage along with campus generated waste.

Under the permit, NIH continues to operate under the same MDE hazardous waste treatment and storage regulations and criteria that have applied since 1987. Treatments include bulking, blending, neutralization, and detoxification using carbon adsorption and ultraviolet peroxidation to reduce the amounts of hazardous waste or make them less hazardous. None of the treatment methods includes or involves on-campus incineration.

In an average year, NIH generates about 5,000 different types of regulated and non-regulated hazardous waste items. The vast majority of discarded material is commercially available hazardous chemical products, or mixtures of these products with nonhazardous chemicals. Overwhelmingly, the individual amounts produced at any one time in any experimental procedure are one liter or less. Approximately 150,000 vials and 50,000 small bottles containing expired or spent chemicals classified as hazardous are produced each year.

The RCRA permit allows NIH to have the capacity to store up to 26,360 gallons of liquid hazardous waste for subsequent treatment, transport, and disposal. This volume represents the cumulative capacity of Building 21 waste management facility, and is for operation of this facility. The actual amount of material on hand at any one time is less than this capacity since waste are shipped once a week to off-site treatment and disposal facilities.

If it is assumed that the chemical/hazardous waste per researcher remains constant in the future, then the amount generated under full Master Plan buildout is estimated to be about 190 tons per year. Under the No Action Alternative generation would stabilize around 150 metric tons.

5.7.3 Animal Waste

Animal waste is classified as solid waste, MPW, or sanitary waste, as determined by waste characteristics. It consists of animal bedding with animal droppings, and wash down from daily cleaning of animal holding areas and cages. Research generally employs pathogen free healthy animals under the care of professionally trained animal husbandry and veterinary personnel. The animals are used in biomedical research frequently in a preliminary step before clinical trials on human patients. They include mice,

voles, rats, guinea pigs, rabbits, and nonhuman primates such as rhesus monkeys and macaques. Others include chickens, chinchillas, gerbils, frogs, and sea urchins. The many differing species are kept because each possesses some characteristic in terms of organs, function, or expected experimental response that closely approximates that of humans.

Animals are housed in Buildings 14 and 28, and in other laboratory buildings around the campus. About 30% of all animals at NIH Bethesda are located in Buildings 14 and 28. Buildings 6B, 7, 10A, 37, 49 and 50 also have comparatively large populations. Most of the new laboratory buildings have been designed to be “animal holding” compatible. Building 14 is the location for the NIH Veterinary Resources Program, but other individual Institutes also have small veterinary programs. All animal facilities are reviewed and accredited triennially by the American Association for Accreditation of Laboratory Animal Care (AAALAC). Facilities are also inspected twice a year by the Food and Drug Administration, and at frequent intervals by internal NIH groups.

Since it is a subset of other types of waste, no breakout or quantification of the amounts of animal waste generated is kept. Animal waste amounts or volumes, however, are included within the general solid waste, MPW, or sanitary waste data given elsewhere in Sections 5.7 or 5.4.4. Bedding material and animal droppings from diseased animals are managed as MPW or processed by heating to sufficient temperatures in a steam autoclave and disposed of as general solid waste. Bedding from healthy animals is disposed of as general solid waste. Wash down from areas housing healthy animals is routed to the sanitary sewer.

5.8 CULTURAL RESOURCES

5.8.1 Historic and Architectural Resources

5.8.1.1 Identified Historic Resources

Under the National Environmental Policy Act (NEPA) and the regulations of the National Capital Planning Commission, environmental assessments of the effects of federal actions must include review of the impacts of potential master plan projects on historic properties. Historic properties both on the NIH campus and within the area of potential effect are identified below, and the impact of NIH Master Plan projects on those historic properties is delineated.

In addition, there is a link between NEPA requirements and requirements under the National Historic Preservation Act of 1966 (as amended) (NHPA). Both require pre-decisional consideration of project impacts on historic resources. Under Section 800.8 of revised Regulations of the NHPA (36 CFR Part 800, effective June 17, 1999), coordination is specifically encouraged between compliance with the National Environmental Policy Act and Section 106 of the National Historic Preservation Act.

Although the Master Plan is not "an undertaking" under Section 106 Regulations (and does not literally require Section 106 review), NIH acknowledges its responsibilities under Section 106 relative to the actual implementation of future construction projects called for in the Master Plan. Relative to these projects, NIH will consult with the Maryland State Historic Preservation Officer and the Advisory Council on Historic Preservation, as necessary, before taking any action called for in the Master Plan that may affect a historic property.

The National Historic Preservation Act's Regulations define what constitutes an “effect” on a historic

property (36 CFR § 800-812). Under the relevant Criteria of Effect and Adverse Effect (36 CFR § 800.9):

“An undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in or eligibility for the National Register. For the purpose of determining effect, alteration to features of the property's location, setting, or use may be relevant depending on a property's significant characteristics and should be considered.”

In 36 CFR § 800.9, the Regulations further state that an undertaking has an “adverse effect” when:

“the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to:

- Physical destruction, damage, or alteration of all or part of the property;
- Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the
- National Register;
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;
- Neglect of a property resulting in its deterioration or destruction; and
- Transfer, lease, or sale of the property.”

5.8.1.2 The Area of Potential Effect

Definitions contained in the Regulations (36 CFR § 800.2) state that the “area of potential effects” for a project “means the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties.” Potential effects identified in 36 CFR § 800.9 were weighed relative to the NIH Master Plan, and it was determined that the primary discernable effects resulting from new construction projects would be visual – thus potentially impacting both those historic resources located on the NIH campus itself, and to a lesser extent those outside of the NIH campus. Based upon the major building setback lines and building heights delineated in the Master Plan, the area of potential effects on historic resources has therefore been set to include the entire NIH campus and the area within a half-mile radius of it. (These visual effects, as well as other potential adverse effects identified in 36 CFR § 800.9, are evaluated in the text below.)

5.8.1.3 Historic Resources Located Outside the NIH Campus

Historic resources located outside of the NIH campus are delineated in Master Plan Figure 3.4.6. This figure locates all historic properties within the boundaries of the Bethesda/Chevy Chase planning area.

The area of potential effect for the NIH Master Plan includes two historic properties listed in the National Register of Historic Places:

- The Bethesda Meeting House
- The Bethesda Naval Hospital Tower

The area of potential effect also includes eight identified historic resources listed in the Montgomery

County Master Plan for Historic Preservation. These include:

- Alta Vista (Site 35/3)
- Leslie Beall House (Site 35/14-13)
- Bethesda Community Store (Site 35/43)
- Bethesda Meeting House (Site 35/5)
- Bethesda Naval Hospital Tower Block (Site 35/8)
- Walter Johnson House (Site 35/46)
- Little Tavern (Site 35/14-3)
- Samuel Perry House (Site 35/4)

The only off-campus historic properties eligible for the National Register and visible from the campus is the Bethesda Naval Hospital Tower Block at the National Naval Medical Center. The tower is situated on a knoll about 700 feet to the east of Rockville Pike and on a direct axis with Building 1 at NIH. The Stripped Classical-style tower, designed by noted architect Paul Philippe Cret, features a 20-story central tower flanked by 4-story wings to the north and south. The hospital is approached via a long semicircular road. The intervening grounds between Rockville Pike and the hospital are covered by landscaped lawn. The hospital is surrounded on the remaining three sides by expanded Naval Medical Command facilities and the Uniformed Services University of the Health Sciences.

Much of the NIH campus is visible from the upper floors of the tower, and the axial relationship between the tower and Building 1 at NIH is strong. Changes in views from the tower will principally be changes in the overall skyline of NIH, as a number of new buildings will be visible from the tower. At lower levels, and in the wings of the hospital, views are blocked by the topography and by the many trees in the buffer area and along the NIH Stream on the NIH campus. Distances between the Naval Hospital Tower Block and most construction proposed in the Master Plan ranges from a quarter to half a mile. The closest building to the Naval Hospital site's visual axis with NIH Building 1 proposed in the Master Plan is a small-scale, one-story, replacement to Building 25. Its scale and low-lying elevation both avoid obscuring views between Building 1 and the Naval Hospital. Like the existing buildings in the same vicinity, the new building would be located on the slopes of the NIH Stream valley, which rise to the east toward the Naval Hospital, and would be substantially hidden from view to and from this direction. The intervening buffer zones on both the NIH campus and the National Naval Medical Center would be retained.

The Bethesda Community Store is located on the west side of the campus on Old Georgetown Road at Greentree Road, and the Walter Johnson House is located on the northwest corner of the Old Georgetown Road/West Cedar Lane intersection. The new construction planned for the west side of the NIH campus is set a sufficient distance from the historical setting of both of these sites, and views between these sites and proposed Master Plan construction sites are blocked by existing buildings and trees in the buffer strip.

Other historic properties listed above are located at a greater distance from the NIH campus. NIH is not visible from these locations, and proposed construction would not affect the properties or their settings.

5.8.1.4 Historic Resources Located on the NIH Campus

Section 800.4 of 36 CFR Part 800 (the Section 106 Regulations) concerns the identification of historic properties, requiring federal agency officials to identify historic properties that may be affected by an undertaking and to gather sufficient information to evaluate the eligibility of these properties for the National Register. Efforts to identify historic properties should follow the Secretary of the Interior's "Standards and Guidelines for Archeology and Historic Preservation" (48 FR 44716) and meet the requirements of Section 110 of the National Historic Preservation Act.

In 1997, NIH sponsored a cultural resource study of all buildings located on the campus over 50 years of age and that exhibited the likelihood of possessing exceptional historic and/or architectural significance regardless of age. In this effort, NIH worked with the Maryland Historical Trust (MHT), which serves as the Maryland State Historic Preservation Office (SHPO), to determine which resources on the NIH campus are eligible for listing in the National Register as either individual resources or as contributing elements to a larger historic district.

To date, the NIH and MHT have reached a consensus determination that the following buildings and historic districts are eligible for listing in the National Register. These properties, including their historic district boundaries, or environmental settings, and significant views and vistas, are depicted on Figure 5-20, and listed below:

The Administrative Complex (or Historic Core) Historic District, which encompasses:

Building 1	Administration Building
Building 2	Industrial Hygiene Building Laboratory
Building 3	Public Health Methods and Animal Unit
Building 4	Laboratory
Building 5	Laboratory
Building 6	National Cancer Institute
Building 7	Memorial Laboratory
Buildings 15B1-15G2; 15H and 15I	The Officers' Quarters
Building 15K (currently Building 15)	Tree Tops (Wilson House)
Building 16; 16A	The George Freeland Peter Estate (Stone House and Caretaker's Residence)
Building 38	The National Library of Medicine
Building 60	The Convent (Mary Woodard Lasker Center)

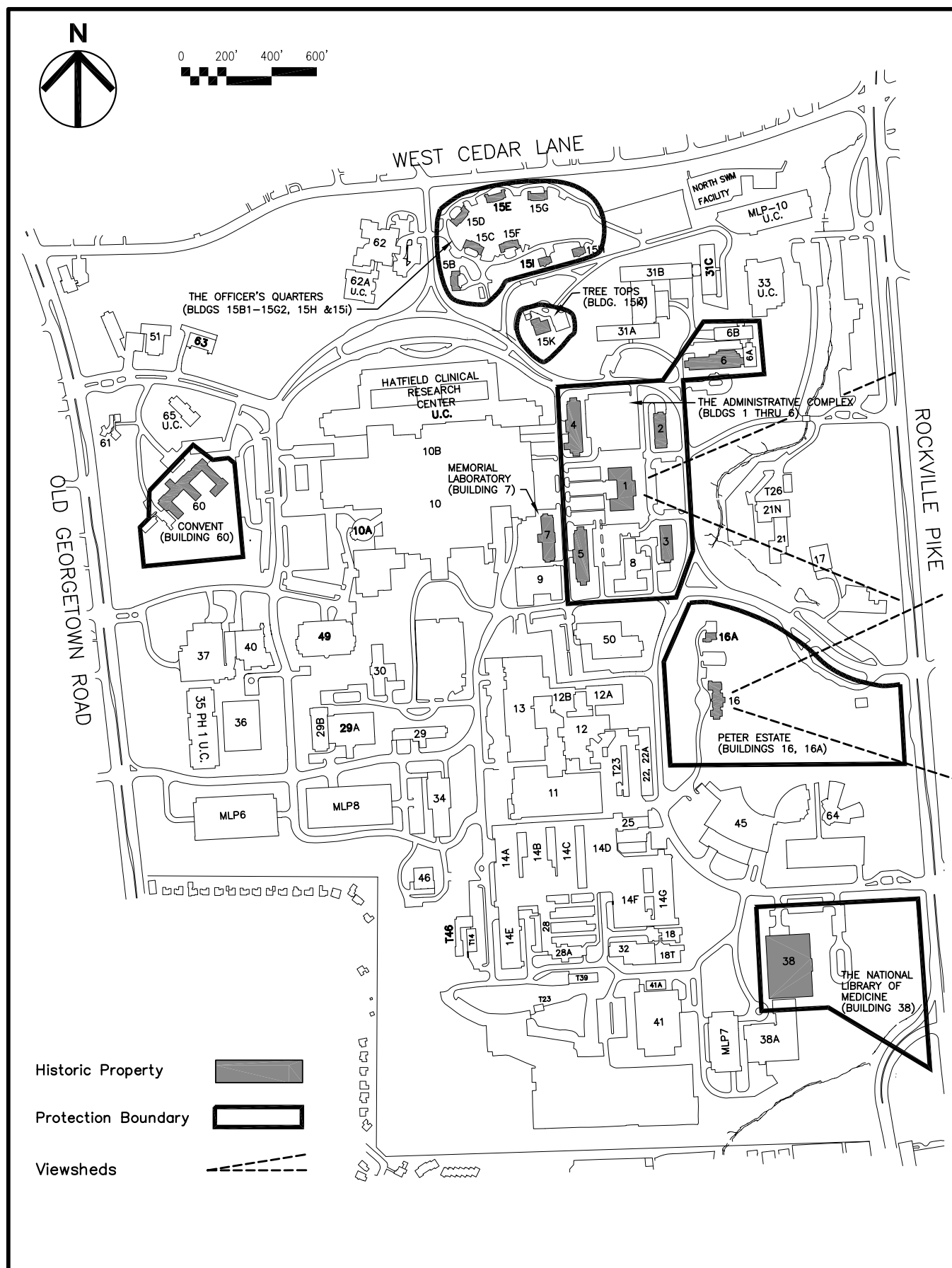
Buildings that have been evaluated, and by agreement with the Maryland Historical Trust, do not meet the criteria of listing in the National Register of Historic Places include:

Building 8	Laboratory
Building 9	Laboratory
Building 10	The Clinical Center
Building 61	Caretaker's Cottage (Convent)

The status of Building 11, the Power Plant, is unclear. According to NIH staff, it has been evaluated and was determined not eligible for listing in the National Register of Historic Places. No determination of eligibility, supporting documentation, or correspondence relating to Building 11 is present in the files of the Maryland Historical Trust. However, it seems unlikely that Building 11, which was completed in 1964, would prove to be exceptionally significant for its history or architecture.

5.8.1.5 Potential Effects of the Master Plan on Campus Historic Resources

Since a master plan is, by definition, a conceptual road map for future development, determining the effects of the plan on historic resources can only be accomplished in a broad context. Factors such as the exact size of planned buildings and proposed road alignments will not be decided until individual projects are initiated. For these reasons, the following analysis represents a preliminary assessment of potential effects generated by the Master Plan undertakings on resources currently identified as eligible for the National Register. This analysis is an introduction to, not a substitute for, future Section 106 review



when project undertakings are actually initiated. Nevertheless, the evaluations below serve as a valuable tool in determining the future success of the Master Plan.

Campus-Wide Effects

From a planning perspective, new development proposed by the Master Plan is integrated into the orthogonal grid originally generated by the Administrative Complex, or Historic Core of NIH. This earliest grouping of NIH-constructed buildings comprises a small historic district, oriented to the east with reciprocal views across Rockville Pike to the tower of the National Naval Medical Center. This is the single highly organized historic area of the campus with other areas of the early campus following more loose planning principles. Although the new quadrangle areas proposed by the Master Plan reorient this eastern focus to a newly planned central mall to the west of the Historic Core, it does respect the earliest geometric intent of the original NIH campus.

Massing and heights defined by the Master Plan take the Magnuson Clinical Center (Building 10) as the focal point of the campus, and create a regular system for building heights that is lowest at the site perimeters and highest in the center of the site. Heights rise five degrees from horizontal at the perimeter of the site in increments, with the tallest buildings at the Clinical Center measuring 140 feet. This tends to provide more protections to historic properties on the periphery or outside of the NIH campus. Within the NIH campus, the increased heights in the center of the site visually impact historic resources more substantially, creating a more urban effect than previously present and diminishing the overall status of historic properties such as the Historic Core.

Architectural principles of the Master Plan call for future development to reflect historic patterns and priorities. Architectural policies and criteria are described as respecting the built environment in terms of materials, style, massing, scale, and color. Open-space tenets of the Master Plan call for respect for historic resources and their environmental settings.

Other campus-wide effects of the plan, which potentially affect historic resources, include the removal of most surface parking, the augmenting of landscaping (particularly around the edges of the campus and along the Loop Road), and the creation of a new Loop Road. The elimination of a majority of the surface parking and its replacement with green space will help to restore the historic settings of a number of the buildings originally surrounded by green space. The elimination of surface parking will be particularly beneficial to the setting of the buildings located in the Administrative Complex (or Historic Core.)

The new, widened, Loop Road does not appear to substantially affect the historic resources that front on it. The historic resources closest to the perimeter road are those located on the northern and eastern edge of the Historic Core (i.e., Buildings 2, 3, and 4). In these locations, the current distance between the buildings and the road will be maintained and the additional road width will be taken from the other side of the street. If proposed utility tunnels adjacent to roadways are implemented, they may have impact on historic resources, e.g., requiring a cut into the hillside to the west of the Stone House. Other historic resources appear to be located a sufficient distance from the perimeter road so as not to be affected. Details of the widened roadway, particularly its exact path, can help protect the environmental settings of the historic properties.

Specific effects to individual historic properties on the NIH campus are addressed below.

Buildings 1, 2, 3, 4, 5, 6 – The Administrative Complex, or Historic Core

Collectively, Buildings 1, 2, 3, 4, 5, and 6 have been determined eligible for listing in the National Register of Historic Places as a small historic district.

- Buildings 1, 2, and 3

Buildings predating NIH's establishment on the site include Building 15K, "Tree Tops"; and Buildings 16 and 16A, the George Freeland Peter Estate; and Building 60, the Convent of the Visitation/Mary Woodard Lasker Center. Completed in 1938, Buildings 1, 2, and 3 are the earliest buildings to be Congressionally authorized and constructed at NIH's Bethesda campus. Collectively, Buildings 1 through 6 form the visual and symbolic core of the NIH site, and are typical examples of the academic Georgian Colonial Revival style used for many contemporary institutional buildings. In addition to their architectural merits, these buildings helped to establish NIH as one of the world's foremost biomedical research centers and are directly associated with major accomplishments in the field. Louis A. Simon designed the buildings, with J. Winthrop Wolcott, Jr., serving as the consulting architect. The George A. Fuller Company of Bethesda was responsible for construction.

- Buildings 4 and 5

Buildings 4 and 5 were constructed in 1941 as identical laboratory buildings. Constructed in the same Georgian Revival style previously used for Buildings 1, 2, and 3, Buildings 4 and 5 continue to represent the trend toward using this academic style. Building 4 was initially used as laboratory and research space, and in 1948 became the primary location for the Institute of Experimental Biology and Medicine. Other institutes housed in Building 4 have included the National Institute of Dental Research, the National Institute of Arthritis and Metabolic Diseases that later became the National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases. Building 5 initially housed researchers in infectious diseases and was home to the Microbiological Institute later renamed the National Institute of Allergy and Infectious Diseases. Because of the nature of this work, Building 5 was constructed with a sophisticated exhaust system that prevented the spread of infectious diseases from room to room within the building. Buildings 4 and 5 were constructed by the Charles H. Tompkins Company.

- Building 6

Constructed in 1939, just one year after Buildings 1, 2, and 3, Building 6 displays similar Georgian Revival characteristics as the earliest NIH buildings. Built initially to house the National Cancer Institute, Building 6 was believed to be one of few structures designed solely for research in a specialized field. Two additions have been made to Building 6: 6A was added to the east portion of the building in 1976, and 6B was added to the north side of the building in 1988.

- Potential Effects to Buildings 1, 2, 3, 4, 5, and 6

The Master Plan calls for new construction or alterations to three areas near the Administrative Complex.

The first area is located to the east of Buildings 1, 2, and 3 in a site bounded by Rockville Pike, Wilson Drive, and South Drive. It is a landscaped valley through which the NIH Stream flows. Here, under the Master Plan, a small replacement to Building 25 is planned in the Building 21 complex. The small scale and low-lying profile of the Building 25 replacement will have no effect on the Administrative Complex. At present, due to the topography of the area and a large grove of tulip poplars along the NIH Stream valley, the existing buildings are barely visible during most of the year from Buildings 1, 2, and 3. Also, as stated previously, the new building would be lower than the tree canopy and would not disrupt axial views from Building 1 to the Naval Hospital Tower. (The existing Building 21 complex is itself not identified as historically significant).

The second area, the area to the west of the Administrative Complex, holds the Magnuson Clinical Center, which has recently been expanded significantly on the north side by the construction of the

Hatfield Clinical Research Center. Under the Master Plan provisions, renovations of the Clinical Center (Building 10) will be carried out over several years. These interior renovations have no effect on the adjacent historic properties. However, the Master Plan identifies a service zone west of Buildings 4 and 5 that continues to serve as a primary service point for the Clinical Center. The combined needs of the new Clinical Research Center and renovated Building 10 require new loading docks and the extension of the steam/chilled water tunnel from Building 11 to the new Clinical Center complex. This requires the demolition of Building 7, a building determined to be individually eligible for listing in the National Register, and also appears to diminish the historic setting of Buildings 4 and 5.

The third area, to the southwest of the Administrative Complex, will comprise the site for two new laboratory buildings, Buildings D and H. Details of their height and massing will affect their possible impact upon the Administrative Complex, but it appears unlikely that they will have any adverse effect on the historic buildings.

The Master Plan also calls for the construction of two new buildings in the vicinity of Building 6, i.e., an addition to Building 6A and Building 33. The Building 6A Addition is placed at the far eastern edge of the primary facade of Building 6, but rather than being attached to the historic original facade is adjacent to a more recent addition. The Maryland Historical Trust has concurred with NIH's finding that the proposed 6A Addition will not adversely affect Building 6. Building 33 is placed northeast of Building 6, adjacent to large-scale additions to it and buffered from it by distance and other factors. It does not affect the character of the historic building.

Building 7 – Memorial Laboratory

Completed in 1946, Building 7 was originally known as Memorial Laboratory to honor scientists who had died while researching dangerous diseases. Building 7 represents a break in the traditional use of the Georgian Revival style of architecture at NIH, although it retains elements of the style, such as massing and materials. However, the distinguishing characteristics of Building 7 are its architectural and engineering details relating to its use as a state-of-the-art laboratory with the mission of providing a safe working environment for scientists engaged in highly dangerous research. Among its sophisticated features are an advanced air-flow system that insures the decontamination of exhaust to the outside of the building, the installation of rooms of various levels of germ decontamination, and triple-sealed windows with exterior shades to avoid the collection of dust on the interior of the building. All of these features were in use to insure the proper handling of potentially infectious diseases.

- Potential Effects to Building 7

Building 7 will be demolished as part of the Master Plan provisions for an enlarged service area for the Clinical Center. As stated previously, this is an adverse impact as it comprises the removal of an individually eligible National Register building.

Buildings 15B1-15G2 and 15H and 15I – The Officers' Quarters

Collectively, the Officers' Quarters have been determined eligible for listing in the National Register of Historic Places. The Quarters are a collection of eight red-brick Georgian Revival duplexes and detached houses constructed in 1940 to serve as housing for junior officers so that they would be on the NIH site at all times. The quarters are an excellent example of the Radburn principle of planning, with residences sited around a common green in a wooded area with gently sloping topography and a series of paths linking the buildings. Louis Simon served as the architect for the buildings, and the Charles H. Tompkins Company was awarded the construction contract.

- Potential Effects to Buildings 15B1-15G2 and 15H and 15I

Distance, topography, and vegetation preclude the effects of Master Plan provisions from having an effect on the Officers' Quarters.

Building 15 (Formerly 15K) – The Wilson House (Tree Tops)

Building 15K, Tree Tops, is the last remaining building and principal residence of the Wilson Estate. Predating NIH's occupation of the site, the Wilson Estate was constructed in 1926 to be the principal residence of Luke and Helen Woodward Wilson. Tree Tops is attributed to architect Edward Clarence Dean, and is a skillful blend of Tudor Revival and Craftsman elements. Various other buildings originally present on the site were removed in 1997 as part of an 850,000-square-foot addition to the Clinical Center.

The Wilsons, both members of prominent merchandising families, were responsible for the major donations of land in Bethesda to NIH. These donations of land were responsible for locating NIH on the site and changing the character of Bethesda from an area with large estates to a densely built area with a prominent medical community.

- Potential Effects to Building 15K

Distance, topography, and vegetation preclude the effects of Master Plan provisions from having an effect on the Officers' Quarters.

Buildings 16 and 16A – The George Freeland Peter Estate and Caretaker's Residence (The Stone House; currently the Fogarty International Center)

The Peter Estate is also listed in the Montgomery County Master Plan for Historic Preservation as Site 35/9.

The Peter House (Building 16), an excellent example of the Colonial Revival style, was constructed in 1930. Designed by architect Walter G. Peter, brother of the original owner, the building exemplifies many of the qualities found in the large early twentieth-century estates that were constructed along Rockville Pike during that era. George Peter sold the estate to the federal government in 1949. The Caretaker's Residence (Building 16A), designed in the style of the main house, is also present on the site.

- Potential Effects on Buildings 16 and 16A

The Master Plan includes alterations to areas to the immediate west of the Stone House complex. The current site is occupied by a group of buildings having mixed uses; some are used for administrative functions while others include vehicle maintenance and storage, shops, grounds maintenance equipment and supplies, and the campus fire station. They are not identified as historically significant. Under the Master Plan, their replacement by H, I, and J/K has the potential to improve the setting to the west of the Stone House. Details of the design and massing of the new buildings will affect the overall potential impact of new construction.

Building 38 – The National Library of Medicine

The National Library of Medicine, which houses one of the world's largest collections of medical literature, has been determined individually eligible for listing in the National Register of Historic Places.

Although the Library was constructed in 1962 and has not yet reached 50 years of age, a period of time that is generally necessary for a building to be evaluated in the greater historic context of its time, the Library displays several areas of exceptional significance. Concerns relating to the threat of nuclear war influenced the choice of a location outside of downtown Washington for the National Library of Medicine, as well as design features thought to protect the building from an atomic bomb blast. Three of its five stories are below grade and its distinctive hyperbolic paraboloid roof shape was thought to dissipate the effects of a bomb blast. Additionally, many progressive features of library design were incorporated into the interior planning of the building in an attempt to manage the extensive holding of the Library. The New York firm of Robert B. O'Connor and Walter H. Kilham were the architects for the building, with Dr. Keyes Metcalf serving as the library consultant for the project. The structural engineering firm of Severud, Elstad and Krueger, one of the pre-eminent authorities on blast-proof construction, served as engineers for the structural design of the Library.

- Potential Effects to Building 38

Certain additions to the National Library of Medicine have been evaluated for potential effect under a separate Section 106 consultation. In response to a letter of February 13, 2002, from NIH to the Maryland State Historic Preservation Officer (SHPO), the SHPO concurred with a finding of "no adverse effect." Design details of Building R, as described in the Master Plan, could require reopening consultation with the SHPO.

Building 60 – The Convent of the Visitation

Constructed in 1922-23 as a self-sufficient, cloistered convent for the Roman Catholic Order of the Sisters of the Visitation, Building 60 remained in use for its original purpose until 1982. Designed by A.B. Mullet and Company, with Marsh and Peter as associated architects, the building reflects Georgian Revival characteristics popular during its era of construction. Romanesque elements, strongly associated with ecclesiastical architecture, were used to articulate the chapel wing.

During the 1980s, the building was renovated for use as the Mary Woodard Lasker Center for Health, Research, and Education. At that time, a residential addition was constructed and linked to the original portion of the building by a modern glass entrance area.

- Potential Effects to Building 60

Building 60's environmental setting, a walled cloistered compound, gives it a protected character. The new Master Plan buildings in its vicinity, Buildings 51, 63, and 65, are small-scale in their massing and will not substantially affect the historic character of Building 60 or impinge visually upon its originally cloistered grounds.

It is possible that other resources not yet evaluated may also meet the criteria for listing in the National Register of Historic Places, or that other buildings, upon reaching 50 years of age, will be eligible for listing. Under Section 110 of the National Historic Preservation Act, federal agencies are required to identify and evaluate historic resources and to ensure that the resources are managed and maintained in a manner that is sensitive to their historic, archaeological, architectural, and cultural values. NIH is committed to working with the Maryland Historical Trust to evaluate the potential historic significance of buildings that are approaching 50 years of age. Until these evaluations are complete, NIH acknowledges that cultural resource investigations will be necessary for individual undertakings to be submitted under Section 106 review. Under Section 106 of the National Historic Preservation Act, government agencies are required to take into account the effects of planned undertakings on historic resources prior to approving funding for the undertaking. NIH will continue consultation with the Maryland Historical

Trust on these and other issues.

Although a Programmatic Agreement and Historic Resources Management Plan are goals to be considered for the future, it is not possible at this time to fund or implement these documents.

5.8.2 Archeological Resources

The NIH campus is located in Maryland Archeological Research Unit 12 of the Piedmont Province. No Phase I cultural survey of the entire NIH campus has been completed. An inventory of known prehistoric and historic sites and identification of areas of potential sites was completed in 1985 (NIH Cultural Asset Inventory, D. R. Bush, 1985). The inventory included a review of Maryland Historic Trust records and files, research literature, and prior investigations in the immediate area, and a visual inspection of the campus.

Other investigations related to the campus include a Maryland DOT survey along Rockville Pike on the eastern boundary from the NIH Stream to Jones Bridge Road in 1981 (The Maryland DOT Archeological Resources Survey Volume 3; Piedmont, Md. Historical Trust, Manuscript Series 7, K. W. Wesler, 1981). This study extended only 50 to 100 feet into NIH property. In 1983, Koski-Karrell and Ortiz conducted archeological surveys of what was at the time the extreme southeast corner of the campus as a preliminary for construction of the Woodmont Avenue extension (Phase I and Phase II Archeological Evaluation for the Woodmont Avenue Extension Project, National Institutes of Health, D. Koski-Karrell, L. Ortiz, J. C. Beasley, 1983, 1986). The sector of this site within the NIH campus was reinvestigated as part of the South Pond installation (Phase II Archeological Evaluation of the South Pond Water Retention Project Area, EAC/Archeology, 2002). Phase I and II surveys have also been completed for the Building 45 site (Phase I and II Archeological and Architectural Investigations for the Proposed Site of the William H. Natcher Building, R. C. Goodwin & Associates, Inc. and AEPA Architects Engineers, 1992). Other studies include a series of Phase I investigations and Phase II evaluations completed for five archeological sites in the northern sector of the campus by EAC/Archeology Inc. between 1997 and 2001.

The first historic period occupancy date in the environs of NIH is uncertain. The property was identified as "Claggett's Purchase" as early as 1716. Robert Peter purchased 600 acres of the tract circa 1760. By 1865, the NIH site had been subdivided between the Peter family, Joseph and H. Gingle, Robert Spate, and Alexander Briton.

By 1879, A. Peter had built a summer house called "Winona" on the present site of the Stone House. In 1902, George Freeland Peter and his three brothers inherited 200 acres of the "Claggett's Purchase" tract presumably from A. Peter. George Freeland Peter received 47.9 acres. In 1931, George Freeland Peter commissioned the design and construction of the Stone House. Winona was demolished and the Stone House, with Colonial Revival architecture, was erected on the same knoll along with a caretaker's house and landscaped grounds. It was one of the substantial County estates built along Rockville Pike in the early twentieth century.

in the area between Woodmont Avenue and Wisconsin Avenue, just north of Stony Creek, and in the present location of the National Library of Medicine (Figure 5-21). It is uncertain whether there were two houses, a relocation, or if one of the sites was an outbuilding. Koski-Karrell found no evidence of foundations and one site was destroyed by library construction.

Robert Spate owned an 82 acre farm in the northwest sector of the campus, and Alexander Britton owned a 61 acre farm in the north central sector along West Cedar Lane. They probably grew wheat as their primary crop, if they followed typical Montgomery County agricultural patterns during the 19th century.

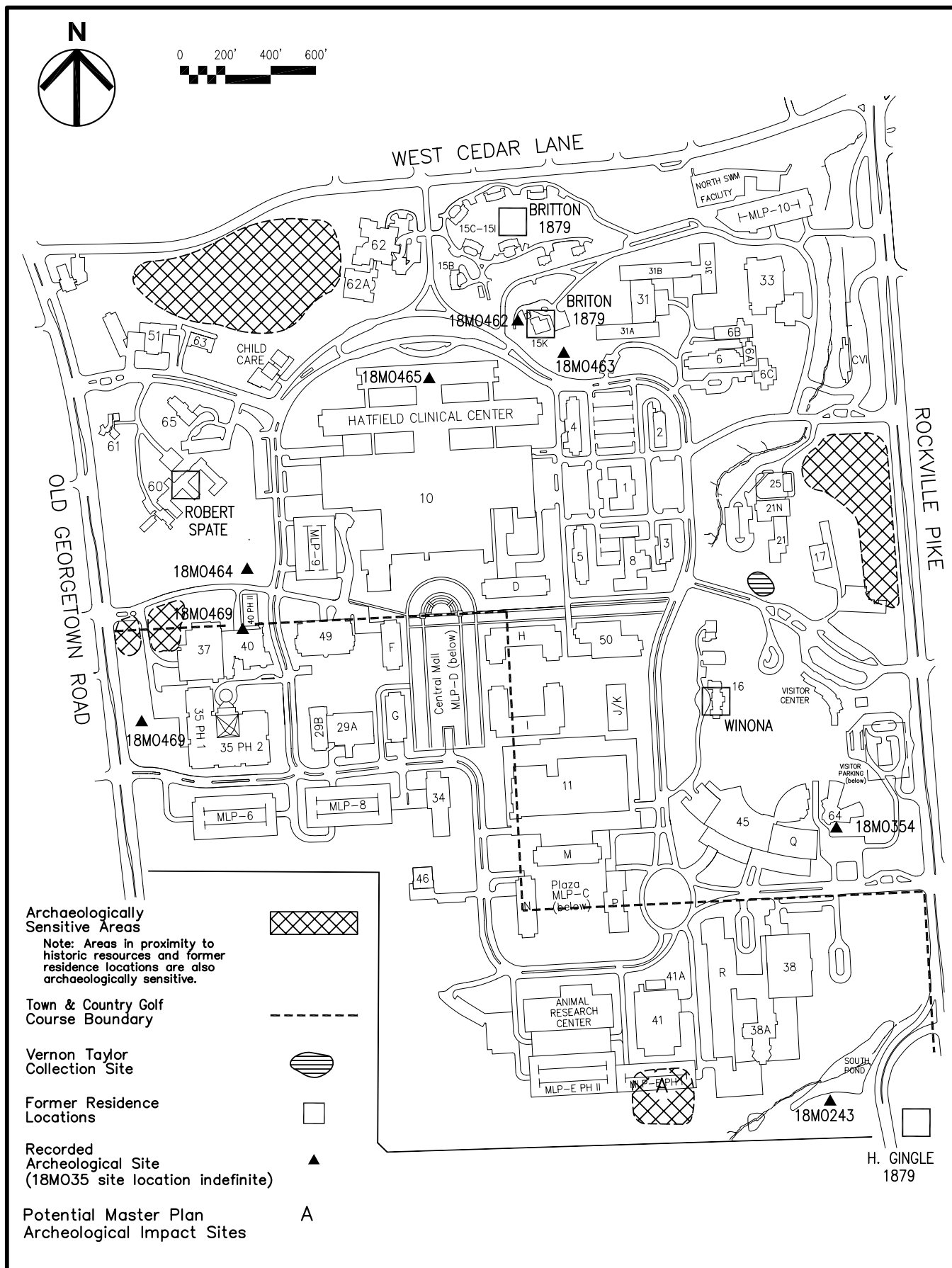


FIGURE 5-21 NIH ARCHEOLOGICAL RESOURCES.

Mapping from 1890 shows the farms distinctly as open fields with trees growing only on the knoll now occupied by Tree Tops. Britton owned his farm until he died in 1907. A subsequent owner sold the property to Helen Wilson Woodward in 1923. Robert Spate sold his farm to the Roman Catholic Church also in 1923 for subsequent construction of a convent.

Both Gingle and Spate were listed in an 1879 directory as farmers. The Peter properties around the Stone House were formally landscaped after 1931, but Phase I surveys around the Building 45 indicate a deep plow zone dating from an earlier period. Other than agriculture, the only other land use was the Town and Country golf course, which occupied the former Gingle property in southern third of the campus in 1920. This golf course was part of the Woodmont Country Club for a short period.

In 2002, there were 23 archeological sites in the vicinity of NIH on record at the Maryland Historical Trust (MHT). Of these, 15 sites were located outside the campus, but within two miles of its periphery, and eight were on the campus. Among the 15 off campus sites, 10 were classified as prehistoric, two as historic, and three contained both historic and prehistoric materials.

Information about campus archeological resources is summarized from the various reports and surveys below.

- Informal Surveys

Informal archeological surveys of the NIH campus include a collection of prehistoric material donated to the Smithsonian Institution by George F. Peter, and a collection of several flaked stone tools and tool fragments by Vernon Taylor, an NIH employee, prior to 1970. Both collectors were amateurs, and materials were gathered through casual, unscientific examination of the surface.

Site 18MO35 has no definite location. Rather, it is documentation of the Peter collection by McNett in 1871, plus a single quartz triangular blank recovered by McNett himself at an unknown location on the campus.

Only one of the three original Taylor sites or areas remains undisturbed. One Taylor site in the northern sector of the campus was overtaken by construction. A second area is now encompassed within, and has been professionally evaluated as, Site 18MO243.

- Site 18MO354

A total of 183 artifacts were recovered during Phase I and II archeological investigations of the site (18MO354). Prehistoric artifacts included 18 quartzite flakes, one fragment of steatite, and nine quartzite fragments. These 28 items accounted for 15.30 percent of the total artifact assemblage. The 42 (22.95 percent) historic and modern materials consisted of architectural and hardware items including nails and window glass; kitchen materials including bottle glass, white ware, pearl ware, ironstone, and domestic brown and gray stoneware. One faunal item, a fragment of oyster shell, also was recovered. A majority of the artifacts were modern materials, including bottle glass (clear, amber, and aqua), foil, metal, plastic, wire, leather, and a .22 caliber cartridge.

The area encompassed by this scatter of modern, historic, and prehistoric artifacts or components has been identified as multicomponent archeological site 18MO354. All components were found as a thin intermixed scatter in the historic plow zone and overlying root mat. No significant concentration of historic artifacts was observed; most cultural materials recovered dated from twentieth century domestic and institutional occupation. Prehistoric materials were found in association with modern and historic materials and lacked temporal context. All components lack integrity and the ability to yield significant

data pertinent to themes in local or regional history and prehistory. This site did not meet Criterion D for eligibility for the National Register of Historic Places, i.e. it did not yield, or is likely to yield, information important in prehistory or history. The site is now occupied in part by Building 45 and the East Child Care Center.

- Site 18MO243

A third site, 18MO243, was originally investigated by Koski-Karrell in 1983. A further survey and evaluation was conducted in the summer of 2002 as part of the South Pond stormwater management project (Phase II Archeological Evaluation of the South Pond Water Retention Project Area,) EAC/Archeology, 2002).

The 2002 Phase II survey for Site 18MO243 dug shovel test pits on a five meter grid throughout the potential limits of the site to the west of Woodmont Avenue. Small clusters of low density prehistoric materials were found, but no ceramics or projectile points that could be assigned to specific prehistoric archeological periods were recovered. The survey also revealed that site soils had been extensively disturbed by prior 20th Century golf course construction, and burial of natural gas, sanitary sewer, and electric power trunk lines that are interspersed throughout the area. The site did not meet Criterion D eligibility for the National Register of Historic Places.

- Sites 18MO462, 18MO463, and 18MO464

These sites are located in the northern sector of the campus. Phase II evaluations surveys of 18MO462, the Knoll site, recovered a mix of historic and prehistoric materials at the investigation site. The site appears to have been a farmstead dating to the late 18th or early 19th century. The principal historic component was a cut stone foundation that appeared to be associated with a smokehouse. Artifact recovery patterns indicated the site extends northward into an area that had been covered by a parking lot in the past.

Documentary evidence for 18MO463, the Tree Tops Terrace site, indicates that it was the location of a 19th century farmstead. Some artifacts dating to that period were recovered during a Phase II survey, but most were 20th century items almost surely associated with the Wilson Tree Tops Estate.

A Phase I investigative survey of 18MO464, the Spate/Convent site, found no trace of historic occupation earlier than Convent construction.

All three sites yielded prehistoric quartz stone tools notably projectile points, numerous quartz flakes generated during tool construction, and cores of quartz from which flakes were struck. Site 18MO463, in particular contained a large quantity of prehistoric material. Quartz occurs in veins in the micaceous schist bedrock at several locations on the NIH campus and is visible on the surface. The exposure is evident particularly in the vicinity of Tree Tops. Projectile point styles indicate that all three sites were occupied intensively in the Late Archaic and Early Woodland periods between 3,000 and 2,000 years before the present.

Prior farming, homesteads, and Wilson Estate and NIH activities have significantly disturbed all three sites. None contained prehistoric features or preserved organic remains such as seeds. All three were found to be insufficiently important for National Register nomination.

- Site 18MO465

A Phase I survey of 18MO465, the Clinical Center site, found it to be completely disturbed by

construction for the original Clinical Center.

- Site 18MO469

In September 1997, a Phase I survey was conducted at the area just across South Drive from the Spate/Convent Site. A prehistoric archaeological site was found, and named the Vaccine Center Site, 18MO469. In February and March 1998, a Phase II evaluation was conducted of the Vaccine Center Site. Although the Phase II evaluation established that the site had been extensively disturbed, the nature of the stone artifacts found there were interesting. Prehistoric quartz quarrying was occurring at the site, as evidenced by the recovery of numerous cores, preforms, and bifaces. Further, the bifaces could be clearly classified into those produced during early, middle, and late manufacturing stages. Also found were seven projectile point fragments. Phase I and a limited Phase II survey were also conducted at the Neuroscience Research Center (Building 23) construction area in 2001. Materials found in the perimeter buffer area on the west side of the site revealed that this area has been used for prehistoric quarrying of quartz and tool making. Although many fragments were recovered, no complete projectile points were found.

It was determined that the Neuroscience Research Center site was related to, and an extension of, the Vaccine Research Center site. Both were subsequently identified as Site 18MO469. No features yielding important information were observed at either site, and no floral or found material permitting dating to prehistoric times were found. Both areas also had considerable soil disturbance dating prior to and including NIH occupancy. For these reasons, the combined 18MO469 sites were determined to be ineligible for inclusion in the National Register.

The ground surface in the central core of the campus, defined here as the area inside the Master Plan Loop Road, has been extensively altered by prior construction. Buildings, roads, loading docks, driveways, sidewalks, and parking lots cover about 90 percent of this area. A review of site topographic mapping indicates that the surface in each of these areas has been graded, cut, or filled to accommodate facilities. Further, the NIH Stream crosses the site from a point to the southwest of Building 46 to the northeast corner of the South and Center Drive intersection in a 96-inch pipe that is as much as 40 feet below the existing surface (See Figure 5-16). The original stream valley has been buried for several hundred feet to either side.

Figure 5-21 shows the few remaining campus areas that have not been investigated previously and remain relatively undisturbed by modern construction. They are identified as archeologically sensitive areas based on their potential, although this does not imply that they contain materials or soil context. Sites in proximity to where historic structures were located also hold potential.

Future construction in these areas will require Phase I cultural surveys prior to design and construction to satisfy Section 106 of the National Historic Preservation Act criteria for determining archeological significance and potential eligibility for the National Register. If Phase I surveys indicate that the areas contain materials of potential significance, then a Phase II survey will be completed. In the master planning process, efforts were made to avoid or minimize intrusion into archaeologically sensitive areas. However, there is one proposed facility in the Master Plan that will require a Phase I survey, if and when it is implemented. This project is MLP-E in the area south of Building 41 (Site A in Figure 5-21).

5.9 NATURAL CONDITIONS

5.9.1 Topography

The Bethesda campus is situated on the undulating topography of the uppermost stream valleys of two small independent tributaries of Rock Creek, which flow from southwest to northeast across the campus.

In general, Old Georgetown Road follows the western divide of the Rock Creek drainage basin with the Boozie Creek watershed lying to the west. At NIH, the actual ridge line passes through the northwest corner of the campus and then runs southward parallel to Old Georgetown Road and about 300 feet to the east of it (Figure 5-22). Site topography is shown in Appendix A.

The peak site ground elevation, 384 feet, is located on the south side of South Drive on the ridge line. Elevations around the Convent (Building 60) immediately to the north of this point range from 375 to 380 feet. Elevations at the northwest and southwest corners of the site at Old Georgetown Road are 370 feet.

The NIH Stream enters the site near its southwest corner, but the stream is encased in pipe below the surface. The surface elevation of the filled area above the stream where it enters the campus is 312 feet. Pipe carries the stream about 2,200 feet to the northeast before it exits to daylight at an elevation of 275 feet to the northeast of the South Drive/Center Drive intersection. Once exposed, the NIH Stream continues to flow northward in a small valley or dell roughly 600 feet across and 30 feet deep until it descends to an elevation of 232 feet at the northeast corner of the campus.

More than half the campus is located on the east facing side slope between the ridge line along the western periphery of the property and the NIH Stream. Between West Cedar Lane and South Drive, a tributary ravine is incised into the general slope along the east-west axis, forming a separate valley up to 40 to 50 feet deep.

Slopes are generally 5 to 10% throughout the area. Slopes increase to 15% or more in the upper reaches of the streams. The upper section of the NIH stream valley has been buried by 10 to 30 feet of fill and the course of the stream and natural topography is only barely perceptible at some locations in the core area of development.

Stony Creek cuts across the southeast corner of the campus, entering it at an elevation of 308 feet and leaving at an elevation of 299 feet. It is separated from the NIH stream valley by a low ridge about 700 feet to the northwest. This ridge descends from 360 to 320 feet in elevation as it crosses the campus.

5.9.2 Geology and Soils

Bedrock under the Bethesda campus is composed of the Lower Pelitic Schist of the Sykesville Formation. In older geology literature and mapping, the schist is also identified as the oligoclase facies (a crystalline variety of feldspar) of the Wissahickon Formation or as the eastern sequence of the Wissahickon Formation (The Crystalline Rocks of Howard and Montgomery Counties, C.A. Hopson, in The Geology of Howard and Montgomery Counties, Maryland Geological Survey, 1964.)

The Lower Pelitic Schist is a member of the Glenarm Series of formations, which are, exposed on the surface over the eastern half of the Piedmont Plateau. It is composed of interlaced beds of medium to coarse grained pelitic (originally depositional mud) schists and fine to medium grained psammatic (originally sand) beds with the latter more predominant near the top of formation. Its age has not been

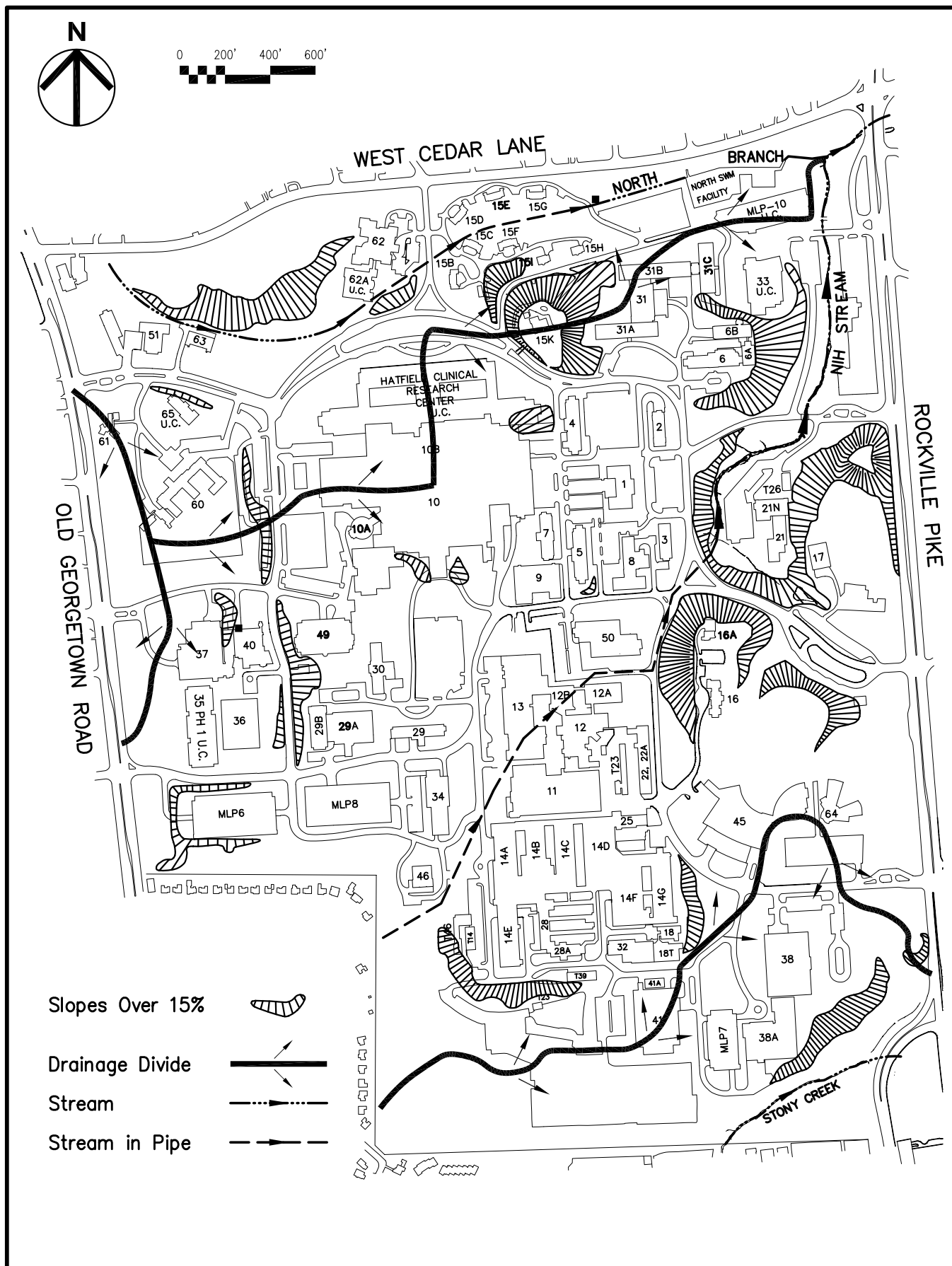


FIGURE 5-22 NATURAL FEATURES AND DRAINAGESHEDS.

fixed but is estimated to be late Precambrian. It has been intensely folded, dislocated, and metamorphosed. The formation is approximately 5,500 feet thick. Bedrock on the campus is generally 55 to 65 feet below the surface but it may be at half this depth in the northeast sector of the site where the NIH Stream has eroded the surface geologically.

The bedrock is overlain by about 15 to 40 feet of saprolite subsurface material. The boundary is a gradual transition, and not a distinct interface. The saprolite is composed of the decomposed and weathered residual crystalline rocks of the base formation. Three distinct saprolites are found under the campus (Figure 5-23):

Saprolite 5B - predominantly well drained micaceous schist

Saprolite 5D - predominantly well drained, silty, bouldery, gneiss

Saprolite 5F - predominantly poorly drained with intermixed clays and mafic rock

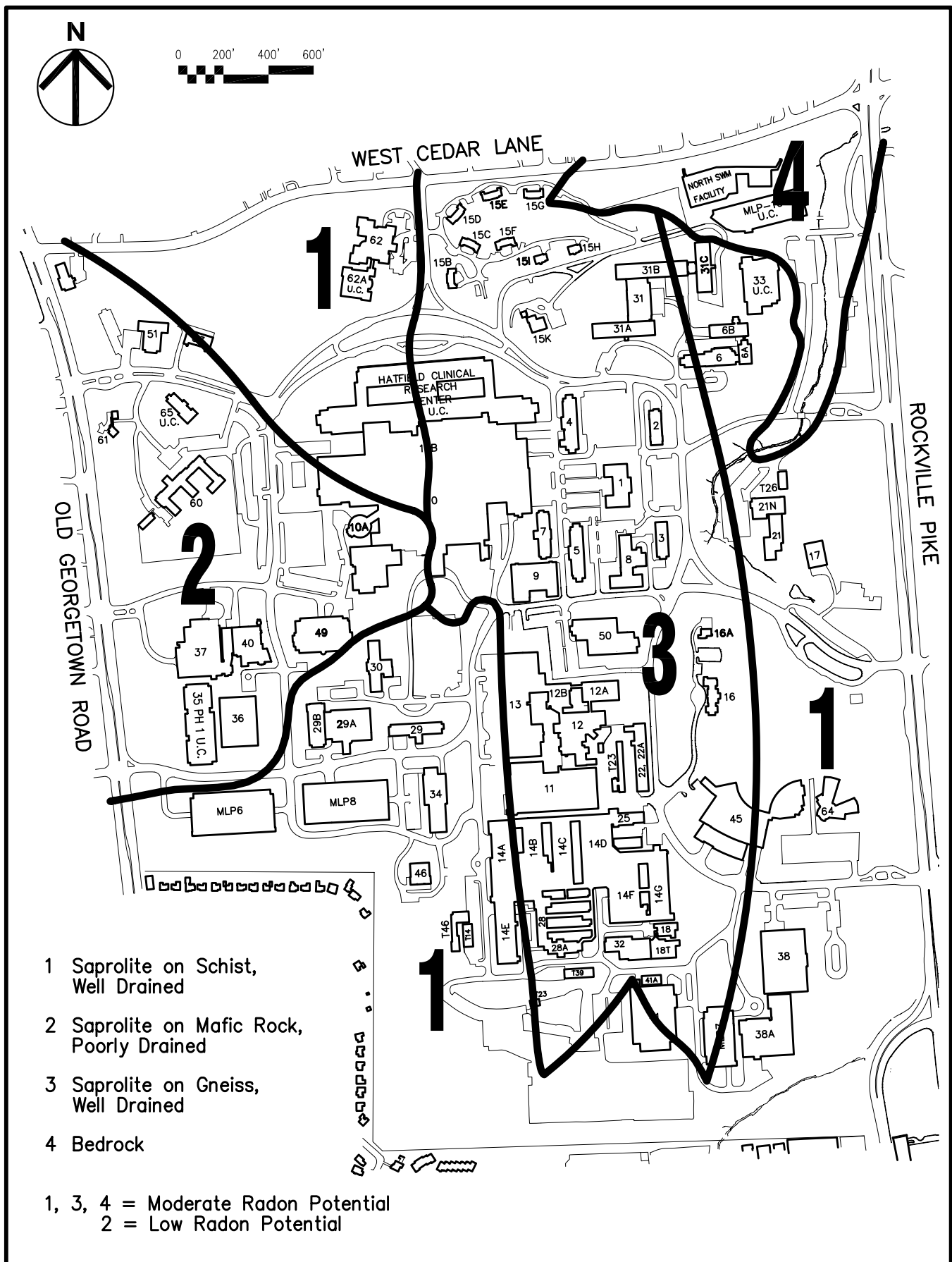
In general, the saprolites consist of sand, silt, clay, angular rock fragments and residual soft red brown to gray earthy porous materials derived from the decomposed crystalline rock. Hard quartzic intrusions may be encountered at widely separated intervals. The saprolites are oriented in the north-south direction. A geologic syncline runs along the axis of Rockville Pike, or just to the west of it so that the surface saprolites on the Naval Medical Center are mirror images of those in NIH.

Radon is a gas that occurs naturally in soils through radioactive decay of uranium. Radon has a natural tendency to move from higher pressures in soils to lower pressures in buildings. The recommended indoor annual average radon level is 4 picocuries per liter of air (pCi/L). Many factors influence the amount of radon at a specific location. Well drained, highly permeable soil facilitates the movement of radon. Daily and seasonal factors occur, but in general, local geology controls the source and distribution of radon in the soils.

Figure 5-23 shows the radon potential for campus subsurface soils. A low radon potential corresponds to a less than 40 percent chance that radon levels will exceed 4 pCi/L in the interior levels of a building below outside soil surface. Radon levels exceeding 4 pCi/L generally will occur only in isolated instances. In areas with a moderate rating, there is an approximately 50 percent chance that building floors below subgrade levels will be in the 1 to 20 pCi/L range, but as many as 10 percent of the buildings measured in these soil areas in Montgomery County can have radon levels exceeding 20 pCi/L (Map Showing Radon Potential of Rocks and Soils in Montgomery County, Maryland, L.C.S. Gundersen et al., USGS, 1988). Radon is not expected to be a site problem in either alternative.

The surface soils range from 2 to 15 feet in thickness (Figure 5-24, Table 5-44). Glenelg silt loam predominates. Much of the central portion of the campus has been disturbed by construction of facilities and surface soils can be a mixture of native, borrow, and fill materials. Most of the area occupied by Buildings 11, 12, 13, and 14 is covered by fill material placed in the NIH stream valley with the bottom of the 96-inch storm drain carrying the stream representing the original ground elevations. Borings for the Building 11 Phase I expansion project imply that the fill extends 300 to 350 feet to either side of stream bed before feathering to native soils. Older soil mapping indicates that within the core area of the campus now designated as urban land (UB), Gaia silt loam was predominate, while Glenelg silt loam predominates to the south of South Drive.

Campus soils have comparatively low nominal erodability. However, erosion control measures are necessary when slopes exceed about 5%, and exposure during construction should be minimized. Cut slopes tend to be stable, and steep slopes can be maintained. Piles are needed for building construction over 60 to 70 feet in height. All but the Baile silt loam and Blocktown-Channery silt loam are good as natural soils for landscaping. The Baile silt loam found in the northeast corner of the campus is the only



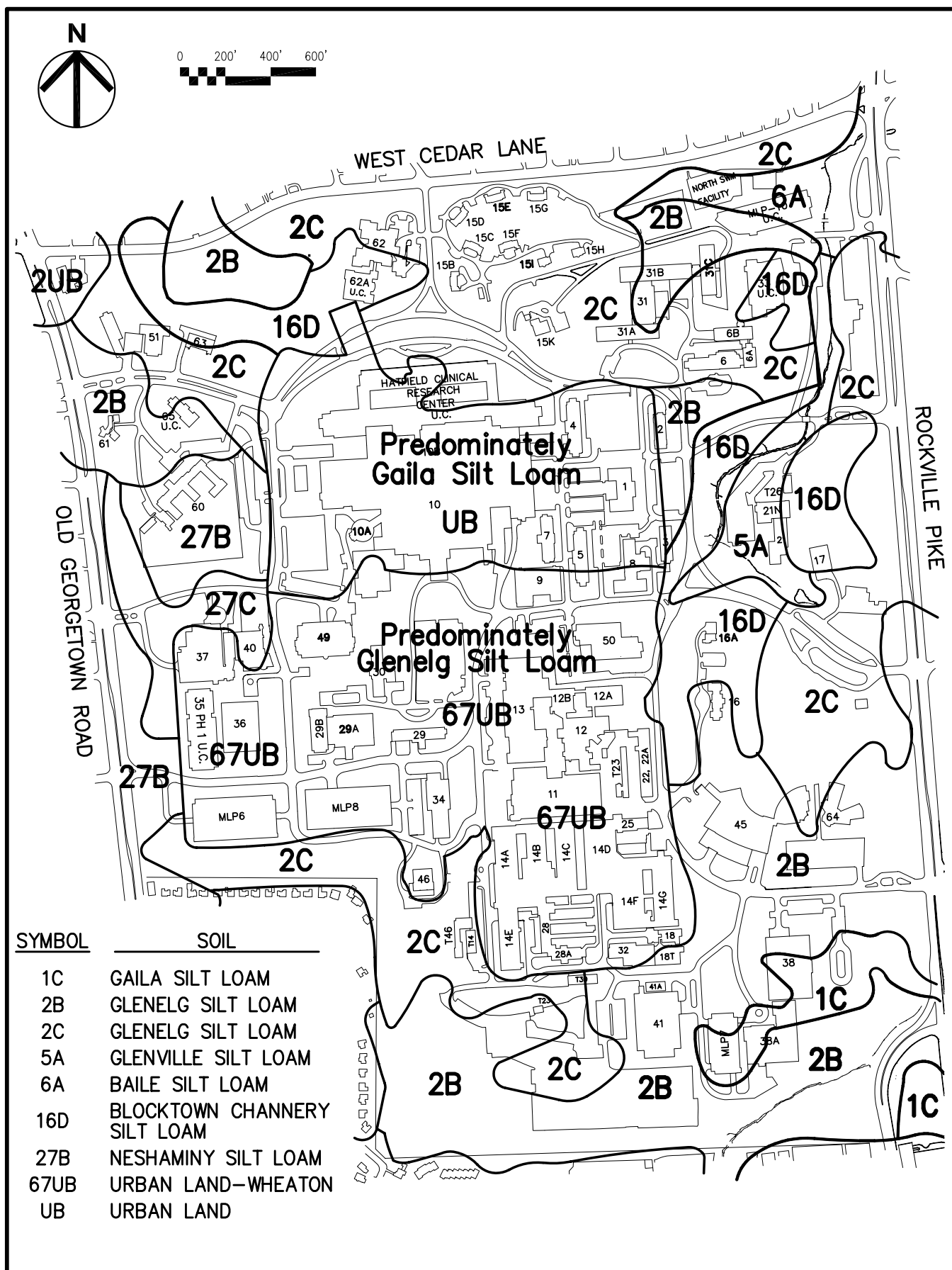


FIGURE 5-24 SURFACE SOILS.

Symbol	Soil	Slope %	Erosion Hazard	Depth To Water(FT)**	Seedling Mortality	Hydric Soil	K Factor
1C	Gaila Silt Loam	8-15	High	Well Drained	Slight	No	0.37
2B	Glenelg Silt Loam	3-8	Slight	Well Drained	Slight	No*	0.32
2C	Glenelg Silt Loam	8-15	High	Well Drained	Slight	No*	0.32
2UC	Glenelg Soils Urban	8-15	Moderate	Well Drained	Slight	No	0.32
5A	Glenville Silt Loam	0-3	Slight	1-3	Moderate	No	0.32
6A	Baile Silt Loam	0-8	Slight	0-1	Slight	Yes	0.43
16D	Blocktown-Channery Silt Loam	15-25	High	Well Drained	Slight	No*	0.28
27B	Neshaminy Silt Loam	3-8	Slight	Well Drained	Slight	No	0.32
27C	Neshaminy Silt Loam	8-15	High	Well Drained	Slight	No	0.32
67UB	Urban Land-Wheaton	0-8	Slight	Well Drained	Slight	No	0.49
UB	Urban Land	More than 80% covered by urban structures					
* Hydric if in association with Baile Silt Loam. ** Depth to normal seasonally high water table.							
Sources:	Montgomery County Interim Soil Report, USDA Soil Conservation Service (SCS), 1990 Montgomery County Soil Report, USDA Soil Conservation Service, 1961 Montgomery County, Highly Erodible Land Report, Update 1985-1992, USDA SCS						

TABLE 5-44 SITE SOILS.

site hydric soil. The Glenelg silt loam with low slopes and the Blocktown silt loam may be hydric when in close association with the Baile silt loam. Hydric soils are defined as those, which are saturated, or flood or pond during the growing season.

General parameters for site soils are shown in Table 5-45. Surface and subsurface soils have good bearing strengths ranging from 4,000 to 8,000 lbs/sf. near the surface to 9,000 lbs/sf at greater depths. Construction of buildings proposed in the Master Plan Alternative would extend to as much as 50 feet below the surface for placement of underground parking, basements, and subbasements. This is not expected to have significant impacts on soils, subsoils, or the underlying aquifer.

The U.S. Geological Survey is currently conducting groundwater investigations in the vicinity of the Medical Center Metro station. The station is located under Rockville Pike between South Drive and Jones Bridge Road. Study data indicates that wells or excavations in the vicinity will encounter two distinct groundwater conditions.

Groundwater in the overlying saprolites may be encountered 10 to 50 feet below the natural ground surface. Boring data from NIH projects and the USGS study indicate that this most frequently occurs 20 to 30 feet below the surface. The saprolites collectively act as one uniform groundwater storage reservoir. The water table in the saprolites does not respond to precipitation events, and wells or excavations encountering the stored groundwater do not produce much drawdown. Transmissivity of groundwater ranges from 0.0001 to 10 gallons/sf/day with the values increasing with depth.

The saprolites are not hydraulically connected to the underlying Sykesville Formation. No infiltration or flow between the two occurs. Instead, groundwater in the Sykesville Formation is present under pressure. USGS test wells just east of Rockville Pike on NNMC show that, although the physical top of the Sykesville Formation is 55 to 60 feet below the surface at the wells, water from the formation rises 30 feet to elevations 25 to 30 below the surface when permitted to flow into wells.

Therefore, groundwater near the top of the Sykesville Formation is present at pressures of about 15 pounds per square inch under undisturbed conditions. Pressures at the depth of the subway station are sufficient to drive groundwater through the seams of the tunnel liner. Groundwater is pumped to relieve pressure on a continuous basis at the tunnel level. It is discharged to the NIH stream on the east side of the Rockville Pike bridge at a rate of 3,500 gallons per hour.

In contrast to the overlying saprolite, the Sykesville Formation groundwater does respond to precipitation events. Groundwater in both formations has a high calcium carbonate content.

Two underground fuel oil storage tanks, each with a 500,000 gallon capacity, are located on the west side of Building 11. These were installed in 1951 when the power plant was built. Smaller underground fuel oil feed tanks are located to the north and south of Building 11. About a dozen other fuel tanks ranging up to 1,000 gallons in capacity are located around the campus on the surface. These tanks supply fuel to emergency diesels and individual pieces of equipment.

In the Master Plan Alternative, the large fuel oil tanks would be replaced with a new tanks on the south side of Building 11 after Building 14 is demolished. In the Master Plan Alternative, the fuel feed tanks on the north side of Building 11 would be replaced when Boiler 7 is installed. Old tanks would be removed or decommissioned in accordance with Underground Storage Tank regulations. NIH has completed a program to bring all underground tanks on the campus into conformance with Federal (40 C.F.R. Part 2800) and State regulations (COMAR 26.13). In the No Action Alternative, the existing fuel oil tanks would be upgraded and remain in service.

Symbol	Soil	Profile*	pH	Permeability (inches/hr)	Shrink-Swell Potential	AASHTO Class	Suitability For		
							Fill/Subgrade	Topsoil	Impoundment Area
1C	Gaila Silt Loam	0-7	5.1-5.5	0.68-2.0	Low	A-4	Fair-Good	Fair-Good	No
2B 2C	Glenelg Silt Loam	0-12 12-24 24+	4.5-5.5 4.5-5.0 5.1-5.5	0.63-2.0 0.20-2.0 0.63-2.0	Low Low Low	A-4 A-6 A-5	Fair-Good	Fair-Good	Suitable
2UC	Glenelg Soils-Urban	25-40% of soil area developed and disturbed.							
5A	Glenville Silt Loam	0-5 5-28 28+	4.5-5.5 4.5-5.0 4.5-5.0	0.63-2.0 0.06-2.0 0.20-0.63	Low Low Low	A-4 A-4 A-5	Poor	Fair	Suitable
6A	Baile Silt Loam	0-11 11-50 50+	5.1-5.5 4.5-5.5 4.5-5.0	0.20-0.63 0.06-0.20 0.20-0.63	Low Moderate Low	A-4 A-4, A-6 A-4, A-5	Poor	Poor	Suitable
16D	Blocktown Channery Silt Loam	0-10 10+	5.1-6.5 4.5-5.0	0.63-6.3 0.63-6.3	Low Low	A-4 A-2, A-1	Fair-Good	Fair-Good	Permeable Substratum
27B 27C	Neshaminy Silt Loam	0-8 8-24 24-48 48+	5.1-5.5 5.1-5.5 5.1-5.5 5.5-6.0	0.63-2.0 0.20-0.63 0.06-0.20 0.20-0.63	Low Moderate Moderate Moderate	A-4 A-4, A-6 A-6, A-7 A-4, A-5	Fair-Good	Good	Suitable
67UB	Urban Land-Wheaton	25-45% of soil area developed and disturbed							
UB	Urban Land	more than 80% covered by urban structures							
* Inches below surface									

TABLE 5-45 ADDITIONAL SITE SOIL PARAMETERS.

5.9.3 Terrestrial Vegetation and Habitat

5.9.3.1 Trees and Vegetation

The grounds of the NIH campus are managed and controlled to the highest degree. Landscaping gives it the appearance of a college campus or urban park. All of the pervious areas around the campus are covered by standard commercial landscape grasses, which are assiduously mowed and maintained, or ornamental gardens. NIH planted more than 10,600 annuals, 7,000 daffodils, and 3,800 Asian and day lilies in Fiscal Year 2000. The only exceptions to this condition are where slopes are too steep to mow and a small tract around the Wilson Estate. The former area is covered by ornamental landscape shrubbery, ground covers such as English ivy and vinca minor, or mulch, the latter by remnant of the original forest. Except for the Wilson Estate parcel, the ground surface is free of natural tree litter such as leaves, fallen timber, and branches. Trees grow under open conditions. There is no shrub or sapling layer, and a natural vertical forest stratification is missing.

In the summer of 2000, NIH conducted a tree inventory or delineation survey of the Bethesda campus. The survey counted all trees with a bole or trunk diameter of six inches or greater at breast height (DBH). A total of 3,530 trees were inventoried with the size (DBH), health, and location indicated. Delineated trees were tagged for future reference. NIH intends to conduct a similar survey of campus trees down to two inches in caliper.

Field observation and review of the survey indicate that much of the campus was covered by a mixed hardwood forest of high diversity prior to NIH occupancy. Oaks (Q. Rubra, Q. Alba) and various undifferentiated hickories (Carya sp.) predominated. Maples (Acer sp.), particularly red maples (A. Rubrum), American Elm (U. Americana), and American Sycamores (P. Occidentalis) were important contributors to the diversity and were a significant percentage of the tree total. Tulip trees or tulip poplars (L. Tulipifera) were grouped in nearly solid groves or stands along the side slopes of the stream valleys.

A vast majority of the mature six inch or above trees are located in the perimeter buffer, particularly in the northern half of the campus, or along the stream valleys. The understory is generally lawn throughout. Trees densities are generally less than 50 per acre, although densities of up to about 85 per acre occur in smaller areas in two locations on the north side of the campus. Tree densities do not meet the MDNR density criteria of 100 per acre for forest.

The campus has five Montgomery County champion trees as follows:

<u>Tree Number</u>	<u>Species</u>	<u>Circumference</u>	<u>Height</u>	<u>Crown</u>
2179	Black Willow	59 in.	54 ft.	61 ft.
2341	Red Buckeye	129	35	42
3040	Japanese Zelkova	99	54	82
4724	Golden Rain	53	46	30
4875	Carolina Hemlock	42	38	24

Champion trees are those that have the highest formulaic sum total of tree bole or trunk circumference in inches and height and crown or spread in feet. The tree locations are shown in Figure 5-25.

NIH has had a formal policy of no net tree loss due to construction or natural causes since 1996. In Fiscal Year 2000, 184 trees were lost for these reasons, but they were replaced with 382 trees planted around the campus. The NIH Grounds Maintenance and Landscaping Section (GMLS) conducts a continuing program for tree inspection, maintenance and care either by staff or by contractor specialists. When

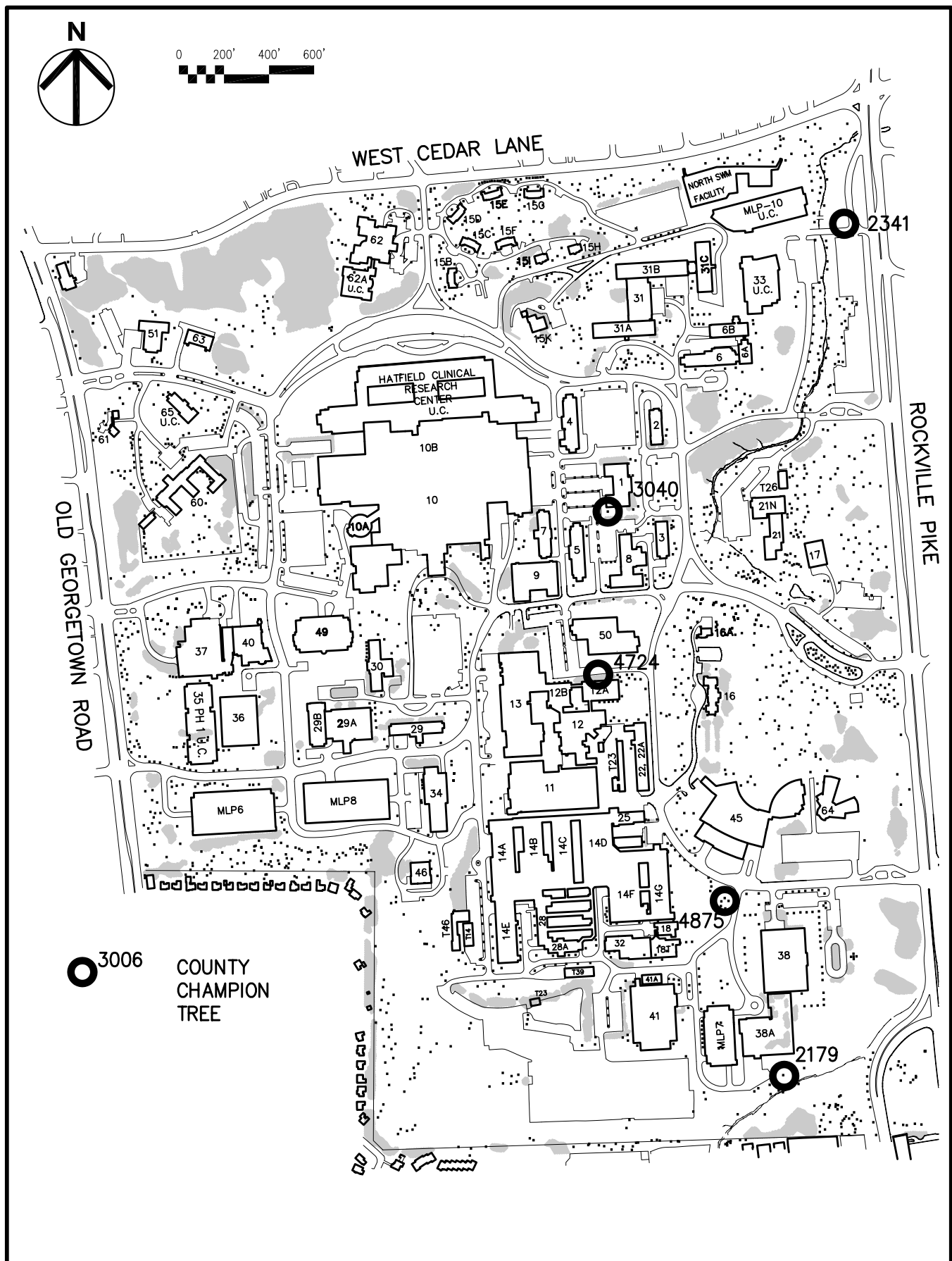


FIGURE 5-25 TREE DISTRIBUTION (FROM AERIAL PHOTOGRAPHY).

feasible, trees that may be affected by development or situation are transplanted. Most transplants are five inches or less in bole diameter, although GMLS has been successful with trees up to ten inches in diameter. NIH is installing drip irrigation systems in selected shrub beds. And, as an innovative measure, groundwater that seeps into the excavations for the many ongoing campus construction projects is pumped and used for grounds irrigation. An estimated 126,000 gallons was recovered in this way in a three month test period in 2000.

The cumulative tree losses associated with implementation of proposed Master Plan Alternative facilities can only be estimated roughly. Losses are dependent on individual project configuration and details, and the number of trees that can be salvaged through transplanting.

It is estimated that about 500 mature trees with a caliper of 10 inches or greater could be lost if all Master Plan facility proposals are implemented. This is an increase of about 200 over that estimated for the 1995 Master Plan. Much of the increase is attributable to more detailed information about campus trees made available in the interim. New facilities that were not in the 1995 Master Plan account for the increase in part. The Visitor Center and Commercial Vehicle Inspection station could require the taking of up to 80 mature trees. No other specific projects would result in an inordinate number of lost trees. The five County champion trees would remain undisturbed by proposed Master Plan development. NIH policy of no net loss of trees would be followed under both the Master Plan and No Action Alternatives. Minimization of tree losses would be determined when individual project site and tree conservation plans are prepared. Project plans would also include mitigation and replacement plans.

It is the goal of the federal government to protect and enhance vegetation and habitat on its facility compounds. The National Capital Planning Commission (NCPC) has issued guidelines in The Comprehensive Plan for the National Capital for achieving these goals including:

- incorporation of trees and vegetation in all federal developments to moderate temperatures and minimize energy consumption.
- encourage the use of street trees to enhance visual and aesthetic features.
- avoid removal of woodland and vegetation from steep slopes and areas with high erosion potential.
- preserve existing vegetation, especially large stands of trees to the extent possible.

The Maryland Forest Conservation Act of 1991 along with the Montgomery County Forest Conservation Law (Chapter 22A) establish a program for conserving forest and tree resources. Effective July 1, 1992, all applications for development, or sediment control permits for construction projects encompassing at least 40,000 square feet of previous area, must be accompanied by a Natural Resources Inventory (NRI), Forest Stand Delineation (FSD), Forest Conservation Plan (FCP), and Forest or Tree Protection Plan (FPP or TPP).

NIH Bethesda is surrounded by an urban environment with the Bethesda Central Business District immediately to the south of the campus. Since it has no forest, conservation is best handled on a “tree” rather than “forest” basis. It is the intent of the NIH to prepare a campuswide Tree Conservation Plans.

5.9.3.2 Fauna and Habitat

The NIH campus is surrounded by five miles or more of commercial and residential development in all directions. The only large tracts within this region that remain natural are park lands used for active recreation or as stream valley parks. The highly controlled natural environment on the campus has limited value as habitat for terrestrial fauna. There is no protective cover at ground level and no substantive natural food resource. The sole exception is the Eastern gray squirrel, which finds ideal conditions among the many oak, walnut, and dogwood trees on the campus, primarily in the buffer area.

Avian species also have suitable habitat. Transient and nesting birds are those common to a suburban environment in the mid-Atlantic area. The human population density of the campus is 40,000 per square mile during daylight hours, and species are generally limited to those that associate with man or are not shy. The campus contains no Critical Habitat.

5.9.4 Water Resources

5.9.4.1 Stream Characteristics and Flows

Three water courses cross the campus: the NIH Stream; a normally dry tributary swale of the NIH Stream which joins the former in the northeast corner of the site; and Stony Creek, designated as such in previous studies (see Figure 5-23). All three are unnamed tributaries of Rock Creek (Basin Code 02.14.02.07). All are classified as intermittent streams on U.S. Geological Survey (USGS) topographic mapping and are non-jurisdictional waters. All have been heavily impacted by past development and now function principally as stormwater drainage courses and process water outfall.

The NIH stream enters the campus in a 42-inch diameter storm drain in the southwest corner. All of the headwater drainage area upstream from NIH is contained in the pipe network of the Montgomery County stormwater collection system. The western boundary of the drainage area follows Old Georgetown Road as indicated by 1910 U.S.G.S. mapping. It is roughly estimated that the drainage area upstream from NIH encompasses about 57 acres (Table 5-46).

The stream crosses the campus in a northeasterly direction, passing under Buildings 12B and 13, in a progressively larger storm drain interceptor for a distance of about 2,350 feet. The interceptor is eight to 20 feet below the surface. Stormwater drains for most of the southwest quadrant of NIH connect to the interceptor throughout this length. Connections carrying chilled water system blow down join the interceptor as it passes Building 11.

The stream finally exits to daylight at a 96-inch diameter outfall northeast of the Center Drive/South Drive intersection, where it immediately passes through two oil and grease separators. Total drainage area upstream of this point is estimated to be 204 acres.

The stream continues to flow north-northeastward toward the northeast corner of the campus for about 2,000 feet. Once exposed, the stream follows a riffle and pool flow regimen, ranging from two to twelve feet in width and averaging about four feet wide. The stream banks are most commonly about 25 feet across and from two to seven feet deep. The width of the stream itself varies from about three to 10 feet.

The stream gradient averages about 1.5% between Center Drive and the Rockville Pike culvert. North of Wilson Drive, the stream winds between East Drive and parking lots for its full length. Eleven stormwater culverts empty into the stream in its exposed section. These culverts have no flow except for north branch in the northeast corner is estimated to be 294 acres of which 212 acres are on the NIH campus.

After leaving the campus, the stream passes under Rockville Pike and Cedar Lane in successive culverts. It then flows through an arm of Rock Creek Park following Cedar Lane and Park Drive through the Locust Hill Estates before flowing into Rock Creek about one mile to the northeast of NIH near the intersection of Cedar Lane and Beach Drive. The elevation at the confluence with Rock Creek is 199 feet based on M-NCPPC topographic mapping.

The NIH Stream is not gauged and there is no information about flow rates. It is uncertain how much of

	<u>Subarea In Acres</u>	<u>Area in Acres</u>
NIH Stream		
NIH Campus Upstream of 96" Outfall	147	
Off Campus - Glenwood Residential Area	<u>57</u>	
At 96" Pipe Culvert Outfall		204
Campus Drainage North of 96" Outfall	65	
Naval Medical & Rockville Pike	<u>25</u>	
		90
North Branch		
NIH Campus	61	
West Cedar Lane & North of West Cedar Lane	<u>45</u>	
		106
Eastern Sector of Maplewood (Outfall at Rockville Pike Bridge)		<u>55</u>
Estimated TOTAL NIH Stream Drainage Area at Rockville Pike		455
Booze Creek		
NIH Campus		5
Stony Creek		
Off-site South of NIH Campus (residential)	129	
Off-site South of NIH Campus (Bethesda CBD)	58	
NIH Campus	<u>32</u>	
Estimated TOTAL Stony Creek Drainage Area at Woodmont Avenue		219
Note: Approximately 12 acres of NIH located to east of Woodmont Avenue drains to Stony Creek separately.		

TABLE 5-46 ESTIMATED STREAM DRAINAGE AREAS (in acres).

the natural flow is attributable to headwater springs, and how much results from ground water infiltration in the storm water system. Using Manning's formula and procedures given in Roughness Characteristics of Natural Channels, USGS Water Supply Paper 1849, 1977, with the average rectangular stream flow channel 7 feet wide and two inches deep, a stream slope of 0.015, and a channel roughness coefficient of 0.50, it is estimated that the average natural flow at Rockville Pike is where $7Q_2$ is the flow which is not exceeded for seven consecutive days at a recurrence interval of, once every two years on the average. Since, the stream is largely "unnatural", being contained within pipe systems, these estimated flows may be in error by plus or minus 70 percent. Flows after rainfall are about 1.0 cubic feet per second (cfs). Using procedures established for Maryland streams (Characteristics of Streamflow in Maryland, Maryland Geological Survey Report of Investigation No. 35, 1983), natural low flow discharges are computed as:

$$\begin{aligned}
 7Q_2 &= 0.201 \text{ cfs} \\
 7Q_{10} &= 0.074 \text{ cfs} \\
 7Q_{20} &= 0.033 \text{ cfs}
 \end{aligned}$$

or storms are estimated to be in tens of cfs. By permit, NIH is allowed to release up to 300,000 GPD (0.464 cfs) of chilled water blowdown to the NIH Stream. Releases vary with chilled water production,

which in turn, varies with the ambient temperature. Under peak production conditions when the temperature exceeds 90°F, the estimated blow down release is 0.39 cfs. During the winter, the average estimated release is computed to be about 0.09 cfs.

The Metro tunnel under Rockville Pike is subject to heavy groundwater infiltration. Water is pumped continuously to the surface and deposited in the NIH Stream on the east side of Rockville Pike. The constant rate of pumpage is about 0.13 cfs.

The north branch of the NIH Stream runs along the northern boundary of NIH. Its drainage area covers the residential area to the north of West Cedar Lane and the northern periphery of NIH. All of the drainage off the campus is encased in the County stormwater collection system. It enters the campus from a series of outfalls from curb catch basins or inlets on West Cedar Lane. On the campus, the watercourse is channelized in a concrete ditch for two-thirds of its length. The remaining mid-third of its length passes under a residential area in a concrete culvert. The entire drainage course on the NIH campus is artificial and merely functions as a stormwater drainage channel. During dry weather, there is no stream flow. Flows are limited to the 24 to 48 hour period after rainfalls with the greatest portion occurring as intercepted runoff.

Stony Creek traverses the southeast corner of the campus in a shallow valley. As is the case for the other water courses, its original stream network upstream from the campus is encased in the Montgomery County stormwater collection system. Two branches join just before entering the NIH campus. The main branch flows through a 66-inch pipe and drains most of the Woodmont Triangle area in the Bethesda Central Business District. The other branch flows eastward in a 42-inch pipe that parallels the southern boundary of NIH and drains the apartment complex area along Battery Lane. Construction documents indicate that the first 200 feet of stream length on the NIH property was subject to channelization when the 66 and 42 inch pipes were installed by the County in the early 1960's.

The stream width varies from 6 inches to 6 feet with an average width of about 3 feet. Stream depths range from one to about 15 inches as it follows a riffle and pool flow regimen. The stream falls only 9 feet as it passes the 1,040 feet across the campus to Woodmont Avenue. It exits the site in twin 66-inch conduits under Woodmont Avenue and proceeds as an independent tributary to Rock Creek across the National Naval Medical Center. It joins Rock Creek about 0.3 mile downstream from the NIH Stream confluence, about 500 feet to the west of Connecticut Avenue.

Where it was channelized by past construction, the stream has banks about 12 feet wide and 3 feet deep. For the remainder of its length across NIH, there are no distinct banks. Maintained lawn extends up to the water's edge throughout this reach. On a basinwide basis, the creek is classified as a Level II, Type F4, stream under the Rosen channel stability rating system. Class F streams are typical of urban conditions. The stream was rated as being in fair to good hydrologic condition in 1998.

Sources and volumes of natural flows in Stony Creek are unknown. Much of the flow during dry weather may be attributable to man-made sources in the Bethesda CBD. The dry weather flow is generally less than one cfs. Studies completed for a proposed County stormwater management pond in the southwest corner of the campus indicate that the one, two, 10, and 100 year storm flows at the Woodmont Avenue culvert are 197, 325, 698, and 1,133 cfs, respectively.

5.9.4.2 Water Quality

The NIH Stream and Stony Creek are designated as Class I surface waters by the Maryland Department of the Environment (MDE). Uses for Class I waters include water contact recreation, aquatic life, and water supply. Water quality criteria for Class I waters are shown in Table 5-47.

Constituent	Concentration Range NIH Stream	Concentration Range Stony Creek	Detection Limit	Maryland State Limits Class I Waters*
Temperature (CE)	3.3 - 23.8	5.6 - 21.8		max 32.2
Electrical conductivity (µmho/cm)	360 - 1050	447 - 510		---
pH (units)	6.4 - 8.6	6.4 - 8.6		6.5 - 8.5
Dissolved Oxygen	8 - 13.4	8.6 - 13.6		min 5
Arsenic	<.005	<.005	0.005	0.05
Barium	0.019 - 0.108	.06 - .086	0.010	1.0
Cadmium	<.0005 - 0.001	<.0005	0.0005	0.01
Chromium	<.002 - 0.033	<.001 - .008	0.0010	0.05
Lead	<.005 - 0.029	<.005	0.005	0.05
Mercury	<.0005	<.0005	0.0005	0.002
Selenium	<.005	<.005	0.005	0.01
Silver	<.001	<.001	.001	0.05
Sodium	3.1 - 30	.97	5	
BOD 5	<1 - 16	<.05 - 1	0.05	
Fluoride-F	0.06 - 3.2	1.1	0.05	
Nitrate-N	0.2 - 8.25	1.81 - 2.76	0.1	
Total Phosphorus	0.14 - 1.0	.03 - .11	0.01	
Fats, Oil and Grease	<5 - 7	<5	5	
Fecal Coliform	20 - >2400**	300 - >2400**	20	log mean 200

Data Source: Water Quality Impact Study, EBASCO and AEPA, 1992.

*Source: COMAR 26.08.05.04

**Results expressed as most probable number of organisms per 100 ml (MPN/100 ml)

TABLE 5-47 PHYSICAL AND CHEMICAL CHARACTERISTICS OF NIH STREAMS (in mg/l unless otherwise indicated).

In adopting a fecal coliform bacteria standard of a geometric mean of 200 MPN/100 ml (Most Probable Number of organisms per 100 milliliters) for water contact recreation, Maryland moved to a position in conformity with the EPA and adjacent states. The standard is applied to all Class I waters in Maryland. In other states, the standard is applied to primary contact waters such as those used for swimming and bathing, and waters with secondary body contact activities such as wading, fishing, and boating have a higher limit. Many of the streams in Maryland do not meet the 200 MPN/100 ml standard, but this does not necessarily mean the waters are unsafe or constitute a public hazard. For example, the geometric mean total coliform densities in the upper reaches of Rock Creek range from 200 to 4200 MPN/100 ml. (Water Quality of Streams in Montgomery County, Maryland, Montgomery County Dept. of Environmental Protection, 1980.)

Water temperature limits in Class I waters have been established to prevent (1) temperature changes that adversely affect aquatic life, (2) temperature changes that adversely affect spawning success and recruitment, (3) thermal barriers to the passage of fish. It does not preclude the discharge of heated water provided the resultant volume and duration of exposure is not deleterious to organisms. Water temperature elevations above natural temperatures must be limited to 5EF and the temperature must not exceed 90EF or 32.2EC outside of the designated mixing zone.

To characterize stream water quality, grab samples were collected from the NIH Stream and Stony Creek during May and August, 1992 (Water Quality Impact Study, in Environmental Impact Studies for William H. Natcher Building, Phase II, EBASCO and AEPA, 1992). This sampling supplements data collected by NIH during 1984 and 1985. Summary physical and chemical parameters of the streams along with fecal coliform counts are given in Table 5-47.

Concentrations and parameters are within Class I water quality criteria. Measurements are within similar ranges taken by on the main stem of Rock Creek near the East-West Highway Bridge in Bethesda (Station RCM0111) (*ibid*). In comparison to Rock Creek, nutrient concentrations (nitrates and phosphorus) are slightly elevated at on site streams.

Dissolved oxygen concentrations are surprisingly high considering the entire upper drainage systems of both streams are enclosed in subsurface pipe networks. However, fecal coliform counts, an indicator of the presence of wastes from human or animal sources, are elevated. Pollutant pet droppings are the likely ultimate sources for the fecal coliforms in this case. Sampling indicates that physical and chemical characteristics improve as the streams traverse the campus. Further dilution is achieved in the NIH Stream by releases from the power plant. NIH affects the water quality of the NIH streams through releases of chilled water system blow down from Buildings 11 and 34. Releases are regulated through National Pollutant Discharge Elimination System (NPDES) permit MD0025496 which is issued by MDE. The current permit allows an average release of 300,000 gallons per day (gpd) provided that total residual chlorine does not exceed 0.1 mg/l and the temperature of the NIH Stream does not exceed 90EF at the point where it exits to daylight to the northeast of the Center/South Drive intersection. This point is 1,400 feet downstream from the underground release points near Buildings 11 and 34. A mixing zone of 50 feet downstream from the discharge basin is permitted. The pH range must be between 6.0 and 9.0.

Under current conditions, NIH meets the NPDES permit requirements. Effluent temperatures monitored at the point of release during the summer of 2000 ranged from 73 to 89° F. The pH of chilled water blowdown releases ranged from 7.0 to 8.1, and the maximum recorded residual chlorine concentration was 0.08 mg/l.

Impacts under the Master Plan and No Action Alternatives are similar except for the volume of heated water released. To accommodate the expansion proposed in the Master Plan, the chiller plant capacity would increase from 43,000 to 80,000 tons. Heated water discharges are projected to increase from

300,000 to 560,000 gpd.

In the No Action case, it is assumed that committed chillers 22 through 27, would still be installed under this Building 11 Phase I expansion. This would increase the chiller capacity to 66,000 tons to meet increasing demands from existing and recently built buildings. This would increase the average daily discharge to about 460,000 gpd.

NIH expects to apply for a new NPDES permit increasing the permitted discharge rate when it is necessary to do so. It is anticipated that the parameters set for temperature, chlorine content, and pH will remain the same. Since the releases under both alternatives must meet the criteria, it is expected that neither will produce significant water quality impacts as a result of power plant heated water releases.

5.9.5 Aquatic Habitat

The NIH Stream and Stony Creek drainagesheds are heavily urbanized and altered by past development at NIH and in the surrounding area. The upper reaches of both streams are encased in stormwater collection pipe systems. Stony Creek drains the Bethesda Central Business District and less than 5 percent of the drainage area upstream from NIH is in natural cover.

A biological assessment of the streams was conducted in April and May, 1992 (Wetlands Assessment, Natcher Building Phase II, Booz, Allen, Hamilton and AEPA, 1992). Both streams had a relatively sterile benthic structure. Submerged vegetation and algae growth was insufficient to support an aquatic community. Vertebrates were not found in either stream. A survey of Stony Creek in 1998 also noted the absence of macroinvertebrates and fish thought its length to Rock Creek.

The NIH Stream is subjected to NIH power plant process water releases that have an elevated temperature. The releases make up most of the dry weather flow. The banks of the stream are now stabilized by concrete blocks rubble, gabions, and riprap. The areas adjacent to both streams are in lawn that is mowed to the top of the stream banks or the very edges of the stream. Both streams receive over land runoff from impervious areas. All of these factors contribute to a reduction in the natural values of the aquatic habitat.

The aquatic habitat of all three campus streams is expected to improve under both the Master Plan and No Action Alternative. NIH is conducting a two phase improvement program for the NIH Stream. In the first phase, which is complete, the stream banks have been stabilized in the short northernmost campus reach between Rockville Pike and the North Branch. The second phase, which was completed in 2003, improved the remainder of the stream both biologically and physically. The project goal is to return the stream environment to its "natural condition". Work included installation a bioretention pool planted with indigenous and native species, bank stabilization using natural stones, rocks, and hydrophilic plantings, and control or retardation of flows from storm drain pipe outfalls and drainage ditches.

Further aquatic habitat improvements could occur when the North and South stormwater management facilities are built. The North facility would be a detention pond on the North Branch just upstream form its confluence with the NIH Stream. The character and type of the South facility, which would be built by Montgomery County, has not been determined. It could take the form of a wet detention pond, micropool, or a series of pools with habitat meeting MDE criteria. In all cases, stream habit would improve. In addition, stream buffers extending 50 feet to either side of streams would be designated as priority areas for tree plantings.

5.9.6 Wetlands

Wetlands are delineated by the presence of three criteria set forth in The Field Guide for Wetland Delineation Manual, U.S. Army Corps of Engineers, 1987. The three criteria are hydric or saturated soils; predominant hydrophytic vegetation; and suitable hydrology in that the area is inundated or saturated with water for a significant period during the growing season. In most cases, all three criteria must be met, but in disturbed areas, it may be necessary for only one or two of the criteria to be present to classify an area as wetland.

Wetland delineation of the campus has been accomplished by a review of available reference materials and information and an on-site investigation of the NIH stream and Stony Creek (William Natcher Building, Phase II Wetlands Assessment, AEPA, 1993). National Wetland Inventory Maps and Maryland Non-tidal Wetland Guidance Maps show no formal designation of wetlands on the campus.

The only hydric or normally saturated soil on the campus is the Baile loam in the northeast corner of the site (See Figure 5-24). Approximately 90% of the soil area is now covered by parking lots. Five test pits dug during the Natcher survey along Stony Creek and the NIH stream revealed unsaturated and disturbed soil structure.

The entire remaining Baile loam surface area is covered by turf or lawn grasses even to the banks of the NIH stream. There are no herbaceous, shrub, or understory layers. Most of the trees in the area are cultivated. There are a few occurrences of natural facultative species within the hydric soil zone such as tulip tree (L. Tulipifera); red maple (A. Rubrum); and silver maple (A. Saccharinum), but landscape and ornamental trees are dominant.

Stony Creek and NIH Stream experience over bank flow after every large or intense storm. The headwaters of both streams are entirely contained within stormwater collection pipe systems draining the Bethesda Central Business District and the NIH campus, respectively. Flows generally return to bank flow within a period measured in hours as runoff is completed. Long-term inundation or saturation is not present. Campus areas bordering site streams can be classed as hydrologic zone V during the growing season in that they are irregularly inundated or saturated.

It is concluded that the wetland delineation criteria are not met and wetlands are not present. No wetland impacts are expected to be created by any of the alternatives.

5.9.7 Threatened and Endangered Species

No threatened or endangered species are known to inhabit the area.

5.9.8 Floodplains

There is no Federal Emergency Management Agency, M-NCPPC, U.S. Geological Survey floodplain mapping for the NIH Stream or Stony Creek.

The NIH Stream floodplain was determined by analyzing the enclosed watershed upstream from NIH as a storm drain system to determine flows at the outfall as it enters the campus. The HEC II computer program was then used to determine the 100-year flood plain for the exposed section of the drainage shed on the NIH campus (Figure 5-26). Flood flows are estimated to be 530 cubic feet per second (cfs) at the point where the stream exists from the piped storm drainage system at Center and South Drives and 656 and 1,016 cfs above and below the confluence of the NIH Stream with its north branch in the northeast corner of the campus. Montgomery County storm drains which drain the eastern portion of Maplewood

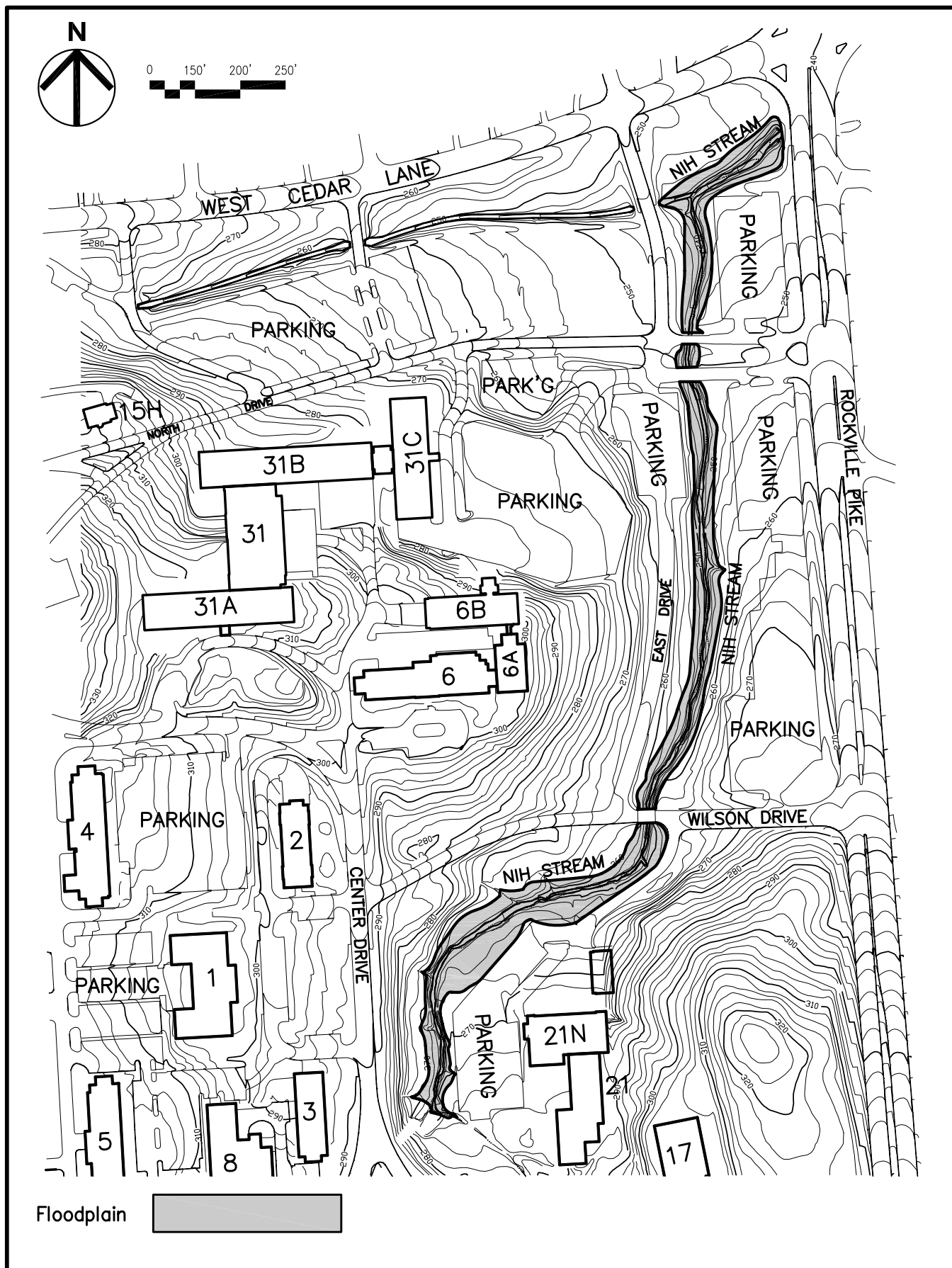


FIGURE 5-26 NIH STREAM 100 YEAR FLOODPLAIN IN 2003.

and Rockville Pike to the north of Cedar Lane empty into the stream immediately downstream from this point.

In flood, the NIH Stream is generally confined within relatively narrow limits widening to 80 feet only in the vicinity of existing Building 21. The Wilson and North Drive vehicle bridges, and three pedestrian bridges all have sufficient clearances to maintain access, although about a foot of backwater is created at the Wilson Drive bridge. The addition of less than one cfs of cooling tower blowdown to the stream at Building 11 has no effect on projected flood elevations. The curb on the west side of the Building 21 parking lot is an important constraint limiting the flood zone in this area.

Stony Creek outfalls from the NIH main campus on the west side of Woodmont Avenue through twin 66-inch diameter culverts. They course to the northeast under Woodmont Avenue passing below the Rockville Pike intersection.

Stony Creek has a gradient of only 0.9% as it crosses the campus. Except for the first 100 feet or so on campus, it does not have well defined banks. These range from nonexistent to 18 inches in height where they occur. Areas adjacent to the stream are flat, and it overflows into these lawn covered areas after nearly any rainfall of significance. While a comparatively large area is flooded under maximum potential flow conditions, the water is not deep.

Upstream from NIH, Stony Creek flows within the County storm drain system. Two storm drains outfall to form the stream just beyond the NIH property line; a 66-inch line which approaches from the south Battery Lane Urban park, and a 42-inch line that runs parallel to and a few feet outside the NIH boundary from the west. The gravity flow capacities of the two lines are 333 and 75 cfs, respectively, or 408 cfs total.

Under normal circumstances, runoff flows follow the above routing. The estimated 100-year storm flow at the entrance to the Woodmont Avenue culverts is 1,133 cfs (NNMC Stony Creek Watershed Study, A. Morton Thomas, 1998). Since the 100-year runoff volume exceeds the storm drain capacity, which is designed to handle 10-year recurrence storm runoff, much of the flood volume will arrive by overland sheet flow through the areas to the south of NIH to reach the Stony Creek 100-year flood pool.

The 100-year floodplain as determined in design analysis for the South Pond is shown in Figure 5-27. The 100-year rainfall in Montgomery County is 7.2 inches in 24 hours. The existing flood water surface elevations of Woodmont and Wisconsin Avenues with the South Pond in place are 308.04 and 307.15 feet, respectively. The difference in stream discharge with and without the facility dam are virtually identical. Water surface elevations are about 0.03 feet (0.36 inches) less under existing conditions. A dam breach analysis for the facility determined that there was no increase in flood hazards downstream.

Under 100-year flood conditions, flood water would flow to a depth of several feet across Woodmont and Wisconsin Avenues. This occurs under both existing and future conditions. Similar conditions occur along MD Route 355 at two locations between the Beltway and Cedar Lane, and in the Bethesda CBD, when 100 year floods occur.

In accordance with Executive Order 11988, Floodplain Management, the Master Plan and No Action Alternatives do not propose construction of non-stormwater management facilities in the floodplain, nor do they support floodplain development in the floodplain within and without the campus. Natural and beneficial floodplain values would be preserved under both alternatives.

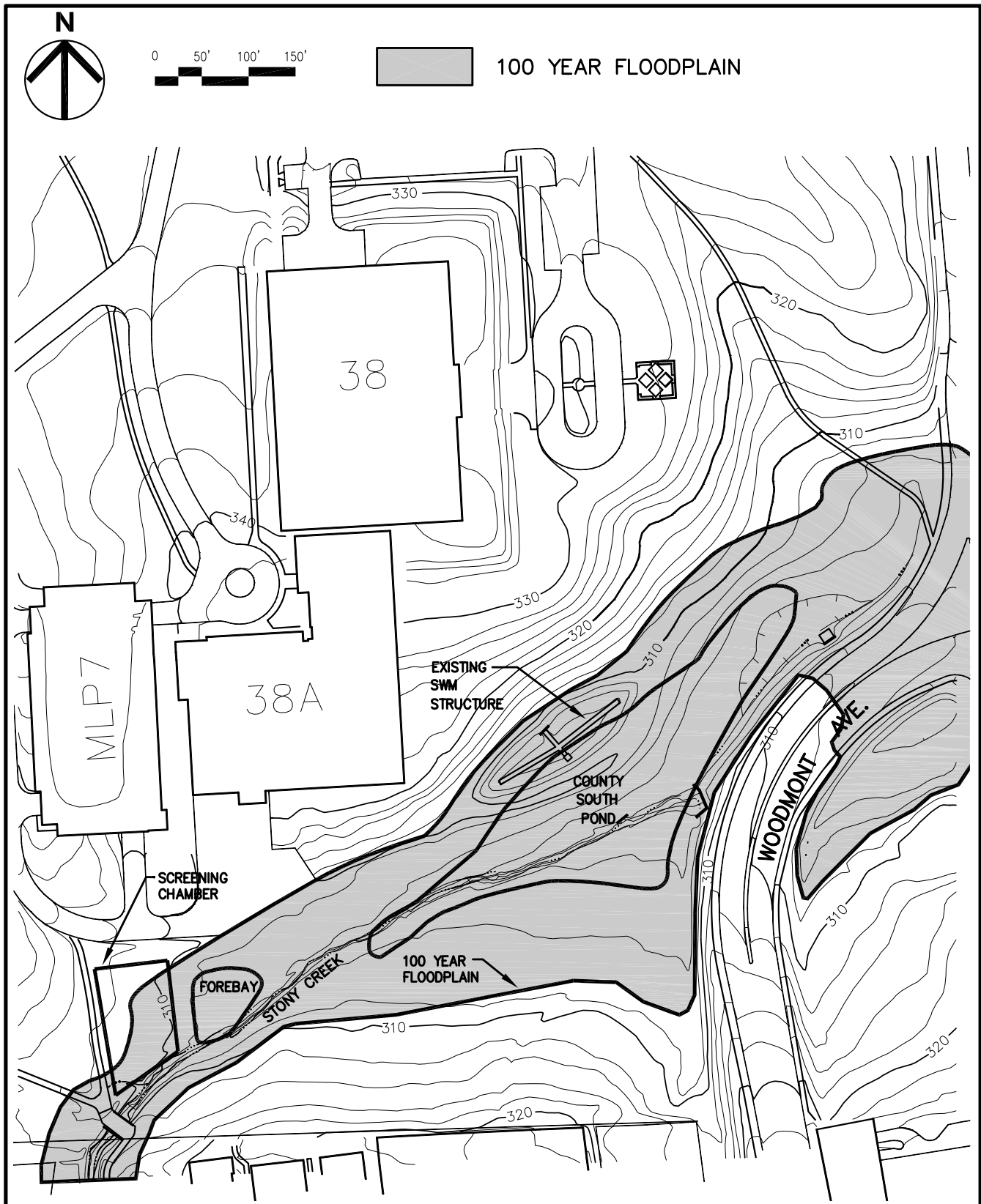


FIGURE 5-27 STONY CREEK 100 YEAR FLOODPLAIN AND SOUTH POND.

5.9.9 Coastal Zone

The NIH Bethesda campus is not in an area governed by the Maryland Coastal Zone Management Program. No coastal zone impacts are expected.

5.10 VISUAL AND AESTHETIC

Implementation of the Master Plan Alternative would create many opportunities for improving the visual and aesthetic character of the campus. These opportunities range from campus wide proposals to subtle touches that can enhance specific small areas.

The Bethesda-Chevy Chase Master Plan notes that a land use element of particular importance to the adjacent communities, as well as those travelling by on Old Georgetown Road and Rockville Pike, is the visual impact of the NIH campus. The B-CC Master Plan emphasizes that the buffer surrounding the campus is critical to continuation of the existing campus ambiance, and as an interface with the surrounding neighborhoods. The plan reconfirmed the need for the buffer around the campus.

The 1995 Master Plan increased the dimensions of the buffer and proposed enhancements throughout its area. The width was increased from 150 to 200 feet as presented in previous campus master plans to a uniform 250 feet (See Figures A-1 and A-2 in Appendix A).

Both 2003 update alternatives maintain the 1995 Master Plan buffer dimensions. Under the Master Plan, the buffer area in each corner of the campus would receive distinctive treatment. Widening the buffer had indirect impacts. With two or three exceptions, NIH was in conformance with the old pre-1995 buffer limits. When the width was expanded, many of the buildings, parking lots, and other facilities built prior to 1995 that were in conformance were now nominally within the new expanded buffer limits.

Designation of a 250-foot buffer ground the entire campus periphery means that 82.1 acres, or more than one-fourth of the 310 acre campus, is unavailable for research and support facilities. For a fixed amount of building space, preservation of the buffer leads to denser development in the campus interior. Denser development subsequently reduces opportunities for green space in the campus interior.

About 66.0 acres of the existing buffer has natural cover. About 1.9 acres are covered by buildings, 6.2 acres by roads and sidewalks, and 7.4 acres by surface parking. The remaining 0.6 acres are occupied by Metro station facilities.

New security conditions will require control of campus access. In turn, this will require construction of associated facilities in the Rockville Pike buffer under both the Master Plan and No Action Alternatives. They include employee vehicle inspection queue lanes at the North Drive entrance, a truck or commercial vehicle inspection station between North and Wilson Drives, and a new Gateway Center and parking garage in the vicinity of the Metro rail station. These facilities combined will convert an estimated 4.9 acres of green buffer to impervious cover.

Elsewhere, under the Master Plan Alternative, roads and sidewalks in the buffer would be reduced to 4.8 acres of ground coverage, and buffer parking by 6.8 acres to 0.6 acre. The remaining parking, is associated with the new fire station, the Children's Inn, and the officer's residences along West Cedar Lane. Exclusive of the new security facilities along Rockville Pike, a net of 8.4 acres of impervious area in the buffer would be returned to natural cover.

Under the No Action Alternative, the road and sidewalk coverage would be reduced in the same manner,

but most of the buffer parking would remain.

The southeast corner is considered to be an important arrival view for visitors. It presents open pastoral views across the Stony Creek valley to the National Library of Medicine and the Natcher Building. The South Pond will create a visual amenity. The Master Plan proposes leaving the area surrounding the pond as relatively unchanged with the addition of a few select trees to supplement and succeed current plantings.

As one proceeds northward along Rockville Pike, the buffer would be relatively open. The BCC Plan notes that the vista of the Peter Estate or Stone House from Rockville Pike should be maintained in any planning effort on the campus, and this is proposed in the Master Plan. Views to and from other potential historic structures and areas are discussed in Section 5.8.1.

Construction of the new Gateway Visitor Center and parking garage at the Metro rail station will create a definitive “front door” entrance to the campus. Site topography, the security perimeter location, and maintenance of bus transit service during construction imply that the new facilities will be oriented to a greater degree in the north-south direction in the buffer zone. The Gateway visitor parking garage would be constructed below grade to minimize visual impacts. The commercial vehicle inspection facility would be suitably screened by landscaping on both the NIH Stream and the Rockville Pike sides.

The northeast corner presents winter views of the campus through the leafless tree canopy on another important arrival route. The Master Plan proposes thickening the tree and shrub cover between Rockville Pike and the NIH Stream in this area. This is already underway as part of the NIH Stream restoration project. Siting of future Building 33 and MLP-10 take advantage of the elevation differential in this area to lower the building profiles and maintain views. Along West Cedar Lane, screening of the residential community by augmented evergreen and ornamental plantings is proposed. The NIH Stream valley would be visually enhanced through the two phase stream restoration program, removal of parking in the northeast corner of the campus along Rockville Pike, and giving it priority as a tree planting area.

In the northwest corner, the plan recommends permitting the tulip poplar grove area to revert to natural conditions with regeneration of the natural understory and leaf litter ground cover. This reversion would reduce maintenance costs and provide additional screening. Along Old Georgetown Road, the wooded buffer at the Convent would be extended to the north and south. Open views of the laboratory complex between South and Lincoln Drives would be maintained.

The Master Plan landscape plan proposes augmentation of the understory and tree cover along the entire southwest edge of the campus from the Lincoln Drive entrance to Stony Creek. The proposed south quadrangle laboratory buildings, Animal Research Center and MLP-E would have a first floor elevation of about 315 feet. Subgrade levels would be built. Ground levels rise to 360 feet along the southern NIH property line and are 340 feet directly to the south of the proposed structure locations.

The ordered massing of buildings, coupled with the concept of intervening quads and malls, will produce a more functional and visually appealing arrangement of buildings on the campus. In general, new, taller buildings would be located in the central core of the campus, emphasizing the concept of Rockville Pike as the “front door” to the campus, concentrating more employees near Metro, and reducing visual impacts in adjacent neighborhoods. Ground elevations decrease from Old Georgetown Road to Rockville Pike. Recommended building heights in the Master Plan Alternative account for building mass relationships between proposed and existing structures. Heights are arranged to create coherent patterns among all campus buildings and to give a sense of hierarchy or visual prominence to the more important ones. Recommended maximum building height ratios to building property line distances are given in the Master Plan to ensure that proposed structures will have unobtrusive skyline profiles, when viewed from

adjacent neighborhoods.

For various sectors of the campus, the Master Plan Alternative recommends general building materials that are compatible with and extend the character of each sector. New construction in the central core area would be built with modern brick designs reinforcing patterns of recently constructed buildings. The plan recommends that the predominant material for buildings in this area be red brick, responding to and respecting the materials used in the Historic Core. Structures white or light in color, and built of stone or concrete, are recommended around the periphery.

Landscaping in the central core would be more formal resembling a well-shaded city streetscape along the Loop Road. Open spaces create opportunities for aesthetic ornamental landscaping on a smaller scale. They have one or more pedestrian routes and offer greater aesthetic diversity than a simple sidewalk next to a roadway. Benches and other features can provide lunchtime respite for NIH workers, and passive recreational opportunities to nearby residents in the evening hours. Trees planted along the periphery buildings can further screen the lower floors from neighborhood view. With the current building arrangement, it would be difficult to improve the visual and aesthetic character of the campus in the No Action Alternative beyond some improvements in the buffer zone.

5.11 ENERGY

Executive Order 13123, issued on June 3, 1998, observes that the federal government is the largest energy consumer in the U.S., and as a result, the government can provide leadership in energy efficiency and reduction of emissions created by energy consumption. The Executive Order has established a number of goals. The first is to reduce energy consumption per gross square foot of federal facilities by 30 percent by 2005 and 35 percent by 2010 relative to 1985 as a base year. Energy consumption per gross square foot is to be reduced in laboratory and industrial spaces by 20 percent by 2005, and by an additional five percent by 2010 relative to base consumption in 1990. Federal agencies shall also reduce greenhouse gas emissions by 30 percent by 2010 compared to such emissions in 1990. Greenhouse gases include carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), ozone (CO₃), and halogenated fluorocarbons (HFC). Reductions are to be accomplished by adopting measures indicated as appropriate by life cycle, cost effective analysis.

The Executive Order also notes that the federal government shall strive to reduce total energy use as well as consequent associated greenhouse gas and other emissions as measured at the source where the source is external to the agency's facilities. Agencies shall undertake cost effective projects in which source energy decreases even if site energy use increase. Agencies shall reduce petroleum use by switching to natural gas renewable energy sources, or other methods.

Overall energy consumption at NIH Bethesda will unavoidably increase under both the Master and No Action Alternatives due to projected overall growth in building space. The No Action Alternative includes new buildings, such as Buildings 40 and 50 and Hatfield Clinical Research Center to which NIH has already committed. The projected growth is:

<u>Year/Case</u>	<u>Research Space (gsf)</u>	<u>Total Space (gsf)</u>	<u>Percent Research</u>
2002 Existing	5,024,000	7,445,000	67.5
2008 No Action Alternative	6,189,000	8,981,000	69.0
2020+ Master Plan Alternative	7,747,000	10,671,000	72.6

Research space includes laboratories, animal holdings facilities, and the clinical research hospital for energy use purposes. Research spaces have much higher utility and subsequent energy demands per unit of space than other types of space used for administration and support. Steam chilled water, and electric power are the three primary energy related utilities. The following compares the peak demand per gross square foot factors for research and other space:

<u>Utility</u>	<u>Research/Laboratory</u>	<u>General/Office</u>
Steam	0.129 lb/hr	0.021 lb/hr
Chilled Water	0.0085 ton	0.0026 ton
Electric Power	0.007 kw	0.004 kw

The day to day demands of each type of space generally correspond to peak demands. Overall campus energy consumption per unit of building space will also increase under both alternatives, because research space with its higher utility requirements will occupy a greater proportion of total campus space.

Research space demands for heating and cooling, which are satisfied by steam and chilled water, respectively, are several times greater than for other types of space. This occurs for two reasons. The predominant one is ventilation requirements set in national handbooks or standards. Most commercial spaces require five to six air changes per hour, i.e. circulated air within the building volume is replaced every 10 to 12 minutes for proper ventilation. The number of hourly changes within hospitals varies considerably by space subtype, i.e. operating rooms patient rooms, administration, but averages about ten per hour. Biomedical research laboratory and animal facility requirements range from 12 to 20 per hour. Additional secondary steam and chilled water demands are attributable to direct or process use in research space. For example, steam is used at the laboratory bench for sterilization, and for cleaning animal holding spaces.

The Master Utility Plan 2000 Update makes the important point that high ventilation rates severely reduce the cost effectiveness of many conventional energy conservation measures, particularly those involving the transport of energy through the building envelope. The air circulating through a research building is resident only for three or four minutes, when the exchange rates are 15 to 20 per hour. It is evident that many conservation measures will be only one-third as effective when applied to research space than they would be applied to other space types, if the respective air change rates are 15 and 5 per hour. Under weather extremes, the amount of energy need to heat or cool accumulated air from outdoor ambient temperatures to interior levels dwarfs that passing through the building envelope in research space. Conservation measures must be evaluated in this context.

The above implies that the most cost effective life cycle energy conservation measures are those that are applied to the air flow itself, i.e. where it is heated and cooled, or where energy that would normally be exhausted is recovered for use. It is in this area where NIH has concentrated its efforts and will continue to do so.

Although growth in utility and energy consumption will occur, NIH is in the process of implementing projects and programs proposed in the 1992 Master Utility Plan (MUP) Infrastructure Modernization Program and the MUP 2000 Update that will reduce the rate of growth. Significant reductions will be realized on a gross square foot basis. And off site source energy consumption and emissions will be reduced.

The first program is the complete renewal of the chilled water plant, which is in progress. Prior to 1991, chilled water was supplied to the campus by fifteen electric driven chillers, one through fifteen. When auxiliary equipment requirements are included, these chillers needed about 1.25 kw of electric power to

generate one ton of refrigeration. NIH is replacing these old chillers with new high efficiency units. Old units one through nine have already been retired, and all but two of the remainder are scheduled for retirement around 2004.

The new chillers need only a comparable 0.85 kw/ton or 32 percent less electric power per ton than the old units. The peak chilled water demand in 1990 was about 34,000 tons. It is projected to grow to about 80,000 tons in 2020 under full Master Plan build out conditions, an increase of 132 percent. However, the high efficiency chillers will limit the increase in chilled water generation electric power demand to only 58 percent between 2002 and full build out conditions.

Installation of the PEPCO/NIH COGEN unit, which includes NIH heat recovery boiler 6 will have several benefits that satisfy Executive order goals. The Executive Order encourages use of alternative financing mechanism, including energy savings and performance contracts, particularly those with “no net cost to taxpayers”. The NIH PEPCO contract to build and operate the COGEN unit meets these conditions through performance clauses. NIH will pay for the facility over ten years by receiving monetary credits for the electricity generated, eliminating the need for federal funding for the project itself.

The Executive Order also notes that federal agencies shall consider combined cooling, heating, and power facilities when upgrading and assessing facility needs. The COGEN unit at NIH will combine all three when the chillers are steam driven. The COGEN unit, in effect, uses “free” energy that would normally be wasted if steam generation was not present. Hot gases from the combustion of oil or natural gas is used to drive a turbine that will generate about 21.6 megawatts of electricity. Exhausted heat is recovered or used a second time to generate 100,000 pounds per hour of steam before it is released up the stack. When desired, supplemental firing will allow NIH to generate up to 180,000 pounds per hour. On an annual basis, the steam produced by the COGEN/boiler 6 system will satisfy about half of the existing demand. By 2020, the portion of steam will still meet approximately 20 percent of the annual campus demand.

The electric power produced in the COGEN unit will conserve off site source energy. Electric power is lost in the transmission through a distribution system; electric resistance in the transmission lines convert power to heat. The greater the distance traveled, the greater the line losses. Power companies may have to generate three or four watts to deliver one watt to the customer. Power generated by the NIH/PEPCO unit will be routed to the nearby PEPCO substation in Building 46, where it can be distributed to NIH and other connected customers. Transmission line losses will essentially be eliminated. Transmission distances are measured in feet instead of miles.

Similarly, NIH will soon be capable of running three chillers with a combined capacity of 15,000 tons with dual electric/steam drives. Steam drive eliminates about 0.6 kw/ton of electric power demand for chilled water generation. If the units are run at capacity, about 885 MW as measured on site, are saved. As noted above, the energy needed to generate this power at off site sources and deliver it to the campus would be still greater.

NIH has also installed free cooling heat exchangers to produce chilled water during the winter. The exchangers use outdoor air to cool the returned chilled water.

NIH has already achieved the Executive Order goals for reductions in greenhouse gas emissions. Since 1992, NIH has successively switched from fuel oils to cleaner burning natural gas as the primary boiler fuel. Natural gas has significantly lower pollutant emission rates per unit of energy consumed than oil or coal. Emissions at NIH have been reduced further by the boiler modernization program, which was implemented in the interim. Measures included the installation of economizers to preheat combustion air and low nitrogen oxides emitting burners. Boilers 1 through 3 also have oversized combustion chambers

with high heat transfer rates between the boiler firing and steam sides. Less fuel is needed to generate a pound of steam than that in conventional boilers.

The resultant reductions in greenhouse gas emissions are dramatic. The 1992 MUP estimated that the 1990 NIH power plant emissions for nitrogen oxides and volatile organic compounds (VOC) were 324 and 4.4 tons per year. The two pollutants combine with sunlight as a catalyst to form low atmospheric level ozone. The corresponding 2001 annual emissions are estimated to be 61 and 1.4 tons, respectively, equivalent to reductions of 81 and 68 percent in 1990 emission levels. Although sulfur dioxide is not a greenhouse gas, the above boiler modernization improvements have reduced annual emissions from 758 to 3.6 tons.

In the future, further reductions per unit of energy consumed will occur, if NIH Boilers 7 and 8 are installed with high efficiency units, as recommended in the Master utility Plan 2000 Update. Such units emit nitrogen oxides at a per energy unit consumed rate that is approximately half that of conventional boilers.

Still further greenhouse gas reductions will be experienced indirectly with double effect. NIH uses low pollutant emitting natural gas as its primary fuel for generating site steam, and electricity in the COGEN unit. Most of the power produced by public utilities and private suppliers is generated using coal, the fossil fuel with the highest uncontrolled stack emission rates. Substitution of on site energy sources for outside power is not only cleaner, but also requires no additional fuel consumption, and consequent emissions, to compensate for transmission losses.

In accordance with the Executive Order, NIH is preparing a Draft Strategic Energy Conservation Plan. The plan identifies additional measures that NIH can take to conserve energy use and lower concomitant emissions. Individual measures must be judged for life cycle cost effectiveness in each application. The measures can be generally categorized as follows:

- Those that match energy delivery to demands more closely. They may be applied building wide or to individual spaces. Measures include state-of-the-art equipment or systems that permit variance in air flow or the energy it contains. These systems are coupled to, and quickly respond to, sensors monitoring conditions.
- Innovative technologies - NIH already has installed an energy recovery heat wheel in the recently constructed Building 50 laboratory. The wheel transfers heat from building air exhausts to supply air streams, it is estimated that the device will reduce peak heating demands by 40 percent. Another innovative concept involves using the steam distribution system to generate electric power that would be sufficient for individual building needs. Steam is driven through the distribution system under pressure. The pressure is reduced at individual buildings for use by passing it through pressure reducing valves. Substitution of small turbines or generators for the valves would accomplish the same reduction. However, about 400 KW of power could be generated using the turbines.
- High efficiency lighting that is tied to programmable controls that permit adjustment of intensity, or automatically shut off lighting depending on space occupancy or night setback schedule. Greater emphasis is given to limiting lighting to work stations and where needed, and to maximizing the use of natural light through fenestration.
- Chilled Water Distribution System Improvements. Water produced in the central plant is released to the distribution system at 42° F. It returns from individual buildings at about 52° F, a ten degree difference. The 1992 MUP and its update recommend increasing the temperature to 18° F. Increasing the temperature increases the amount of heat a fixed amount of chilled water can

transport. Since a greater amount of heat can be carried, distribution system pipe, pumps, and equipment do not need to be enlarged to increase system capacity. All new central plant and building systems are installed in accordance with the 18 degree design criteria. Full realization of benefits will require retrofitting older buildings.

- Submetering of steam, chilled water, and electric power that the building level to monitor demands, and evaluate energy conservation measures.
- Replacement of existing central plant computer control systems with modern state-of-the-art steam and chilled water control and monitoring systems.

5.12 CONSTRUCTION

Physical facility requirements for conducting and supporting biomedical research change continuously. Revisions to national building codes, hospital laboratory design standards, and regulation for occupational safety and handling materials and wastes respond to these changes. Increasing emphasis on electronics and computers place greater stress on electric power and air conditioning systems. Useful life expectancies for laboratories and hospitals are 40 to 50 years, and major renovations are frequently needed every 20 to 30 years.

The Bethesda campus has more than 70 buildings. The number of buildings, coupled with the need to continually modernize and upgrade facilities is such that construction at NIH Bethesda would still occur on a continuous basis under the No Action Alternative as existing buildings and utilities are renovated, rehabilitated, and repaired. Renovation and repair with continued building occupancy takes longer than new construction.

The Master Plan proposes construction of 30 new buildings and parking structures, demolition of 12 existing buildings, and renovation of four buildings. In addition, the Master Plan proposes upgrading the streetscape and utility infrastructure, new malls with underground parking, sidewalks and landscaping, and demolition of surface parking.

Currently, construction is underway at Building 11 on two projects, expansion of chilled water production and installation of the PEPCO cogeneration plant. The fire station, Children's Inn expansion, and Neuroscience Research Center are also under construction. Even if the Master Plan is not fully implemented, construction will be underway around the campus on several projects on a continuous basis.

The brunt of construction impacts will fall on NIH operations and employees because of proximity. Those in buildings adjacent to sites will experience the greatest amount of construction related noise, dust, and traffic. The degree to which these factors affect daily research operations or laboratory equipment, instrumentation, and conditions will run the gamut from negligible to severe, even within a single building. For some projects, such as the Central Mall and Loop Road, it may be necessary to close internal campus streets temporarily and detour traffic. The number of parking spaces on campus will fluctuate up and down as new parking structures are opened and old surface lots are demolished.

The greatest impacts to employees will occur with the Building 10 renewal or renovation. Construction is scheduled to be underway nearly continuously through four phases that will take 15 years to complete. Approximately, one-fourth of the building will be out of service in each phase. In the initial step, some of the employees will be rotated into the new Clinical Center, to vacate space for the first renewal phase. Subsequent phases will involve employee transfers internally within Building 10 as well as to and from other on site facilities as each newly renovated area is available for occupancy.

Construction impacts on surrounding residential community are dependent on proximity and general duration. Those projects with the highest potential site construction impact that are 500 feet or less to the nearest residence are:

<u>Project</u>	<u>Distance to Residence</u>	<u>Community</u>
North SWM Facility	150	Maplewood
MLP-B	300	Maplewood
MLP-E	400	Battery Lane
Building 34 demo/Building L	475	Edgewood/Glenwood
Loop Road/Utility Tunnel	500	Edgewood/Glenwood

Mitigation of construction site impacts would be determined at the time of project implementation when more specifics are known about the project and the resultant necessary mitigation.

Truck traffic associated with construction depends on the state of work. It can range from none or a few for several weeks to a steady stream arriving and departing every few minutes. Operations involving high truck volumes include hauling demolition and excavated soil materials away from the site, and delivery of the basic structural materials such as concrete, masonry, and steel framing.

Under both Alternatives, all construction truck traffic will enter the campus via the commercial vehicle inspection area off Rockville Pike. Departures will be entrances assigned by individual project specifications.

5.12.1 Noise

Maryland has established a maximum noise level limit of 90 dBA at property boundaries for construction sites (COMAR 26.02.03). This limit is applicable from 7 AM to 10 PM. During the hours from 10 PM to 7 AM, the maximum allowable noise level from construction at receiving residential properties adjacent to construction is 55 dBA. Limits do not apply to pile driving, but it is permitted only between 8 AM and 5 PM.

Noise is produced during construction by equipment, transport and handling of materials, construction related traffic, and powered hand tools. The dominant noise source at construction sites is gasoline or diesel driven equipment. Noise from different types of equipment varies by model, manufacturer, and muffling system. Tables 5-48 and 5-49 give reference noise levels at 50 feet from the source for various types of construction equipment and general construction operations.

Soils at NIH Bethesda have a relatively high load bearing capacity. Many existing campus structures are built on piles, and in general, piles will be needed for buildings over 60 to 70 feet in height. Soil characteristics are such that piles can be installed using the caisson method instead of being driven to refusal. In the caisson method, holes are drilled for piles, then the piles are inserted and grouted in place. This method is quieter than the driving method, where repeated blows are applied to the top of the pile until a set depth is reached or no further movement is recorded.

Noise would also be generated by construction related truck traffic hauling dirt and delivering concrete, steel, lumber, masonry and a myriad of other materials. This truck traffic would increase average noise levels (Leq) by 1 to 3 dBA in the vicinity of campus streets depending on the volume of traffic on a given day.

	RANGE (in dBA)	AVERAGE (in dBA)
Cranes	70-90	76
Backhoes	74-92	84
Front End Loaders	77-94	85
Bull Dozers	77-95	88
Compressors	83-92	88
Compressors With Silencers	70-78	75
Jack Hammers	95-105	100
Source: <u>Highway Construction Noise: Measurement Prediction and Mitigation</u> , FHWA, 1977		

TABLE 5-48 CONSTRUCTION EQUIPMENT NOISE LEVELS AND RANGES AT 50 FEET.

	AVERAGE (in dBA)
Ground Clearing	83
Excavation	88
Foundations	81
Erection	81
Finishing	88
Source: <u>Noise from Construction Equipment and Operations, Building Equipment and Home Appliances</u> , EPA, 1971.	

TABLE 5-49 CONSTRUCTION OPERATION OR PHASE NOISE AT 50 FEET.

Distance From Source	One Bulldozer		Four Bulldozers	
	Hard	Soft	Hard	Soft
50 ft	88	88	94	94
100	85	83.5	91	89.5
200	82	79	88	85
400	79	74.5	85	80.5
800	76	70	82	76

TABLE 5-50 ATTENUATION OF CONSTRUCTION NOISE WITH DISTANCE (in dBA)..

Individual pieces of equipment can emit noise levels as shown in Table 5-48. Overall noise levels from 2, 3, and 4 units of a given type operating simultaneously from 2, 3, and 4 units increase by 3, 4.7, and 6 dBA, respectively, if they are all operating within a 50 foot diameter circle. For example, for bulldozers:

<u>Units Operating</u>	<u>Noise Level at 50 ft (dBA)</u>
1	88
2	91
3	92.7
4	94

Noise levels are attenuated by distance, and the level of attenuation is a function of the ground cover of the area intervening between the source and the receiver. If hard or paved, a 3 dBA reduction with successive doubling of distance is achieved. If the ground is soft or has natural cover, a 4.5 reduction with doubling of distance is achieved. Example noise levels are given in Table 5-50 for one and four bulldozers operating at a single location (50 foot diameter circle) and with hard and soft ground cover. As a construction noise mitigation measure, NIH would commit to the following for inclusion in construction specification, where feasible:

- Mix concrete off-site instead of on-site, where practical.
- Use electric instead of diesel or gasoline powered equipment.
- Use hydraulic instead of pneumatic tools.
- Schedule noisy operations to coincide with times of highest ambient noise.
- Turn off idling equipment when not in use.
- Provide enclosures around stationary equipment.
- In construction areas within 500 feet of residences, require contractors to use quieter methods and powered equipment.
- Require silencers on air compressors

5.12.2 Fugitive Dust

Fugitive dust is defined as natural or man made dusts that become airborne due to wind or human activity. Construction associated with fugitive dust is generated by operations that expose or handle soil such as site clearing, excavation, fills, cuts, and grading operations. Quantities of dust generated depend on construction practices, the frequency of operations, the weather, and soil characteristics. Large amounts of dust can also be generated by demolition activities. Where demolition is internal to buildings, NIH General Provisions in construction contract specifications require drop cloths, drapes, barriers, and partitions to control dust and dirt that can be spread by tracking or air currents. The effect of outdoor heavy construction activities and site preparation on air quality are generally short-term and confined to the vicinity of construction activity, i.e. normally within 500 feet.

NIH is committed to including the following mitigation measures in construction specifications:

- Contractors comply with applicable State regulations governing open bodied trucks carrying loose materials.
- Areas disturbed during construction would be seeded and stabilized as soon as possible.
- Provide stabilized stone construction entrances.
- Apply spray-on adhesives to mineral soils.
- Sprinkle or wet high dust areas.

5.12.3 Sedimentation/Siltation

Sedimentation and siltation can occur when stormwater runoff flows over exposed soils without vegetative or protective cover. All construction contracts would be completed in accordance with the 1994 Maryland Standards and Specifications for Erosion and Sediment Control.

5.12.4 Scheduling

In general, contractors are permitted to work at NIH only from 7:00 AM to 4:00 PM, Monday through Friday, in accordance with the General Provisions on NIH's construction contract specifications. Some construction activities are completed outside of these hours to minimize disruptions to campus operations and activities. For example, building utility services connections to the campus systems can be made most easily during the evening or weekend hours. During these periods, they can be shut down or segmentally disconnected when loads or service requirements are comparatively low.

Contractor employee traffic would arrive between 6:30 and 7:00 AM and depart between 4:00 PM and 4:30 PM. Most contractor employees now park at a lot in Pooks Hill and are shuttled to the campus.

Delivery and unloading of construction materials are generally restricted to the normal working hours. Deliveries may occur throughout the day. Construction specifications at NIH assign specific pre-approved routes to the work site for deliveries. Future specifications can route truck deliveries to the Rockville Pike and South and Center Drive entrances or to the Center Drive entrance on Old Georgetown Road as a mitigation measure.

5.12.5 Construction Waste

Construction generates considerable amounts of waste materials and debris. These include materials from demolition; trimming and fitting; and packaging and shipping. Based on current generation from renovation projects, it is estimated that about 1,500 tons per year of construction wastes will be produced. There will be considerable variance in amounts depending on the number and type of projects underway at any one time. NIH General Provisions in construction contract specifications require prompt removal of all waste material and debris.

5.12.6 Hazardous and Other Materials

NIH has a standard protocol for inspection and removal of hazardous and other materials prior to demolition. The inspection and testing phase can last for several weeks; removal of materials, several months. If necessary, prior to demolition or renovation, radioactive, chemical, and biomedical materials would be relocated using standard NIH procedures for distribution, handling, storage, and collection of such materials. If the contractor uses hazardous working materials in the course of work, the contractor must maintain Material Safety Data Sheets, and store, handle, and use the materials in accordance with OSHA regulations.

Asbestos was commonly used for nearly half a century in standard construction prior to investigations revealing its potential hazards. Asbestos is most frequently found as pipe insulation, as a sprayed on fire retardant protective covering for structural beams and columns, and as vinyl asbestos tile flooring. Removal is accomplished by specially trained and permitted contractors. Work areas are sealed to prevent airborne transmission of fibers beyond the work area. Work involving asbestos removal, and disposal is strictly controlled by Federal regulations, including EPA regulations at 40 C.F.R. Part 61, Subpart M, and OSHA regulations at 29 C.F.R. § 1910.1101.

5.13 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

The Master Plan is a guidance document for future development. Any adverse impacts are therefore conditional upon implementation of individual projects proposed in the plan.

Unavoidable adverse impacts associated with the Alternatives, if implemented, include:

- **Construction Impacts**

If the Master Plan Alternative is fully implemented, about 70 to 80 large construction projects would be necessary to build new buildings and demolish existing buildings, expand and upgrade the utility support structure, consolidate campus parking in structures, and improve roads, walks, malls, and landscaping. The Bethesda campus has more than 70 buildings. The large number of buildings is such that at any one time, there is a need for renovation or expansion of buildings. While the No Action Alternative proposes no new development beyond that needed to satisfy regulatory criteria and serious overcrowding, construction would still be necessary.

The number of projects associated with either alternative implies that construction would be underway on one or more projects on the campus on a continuous basis over the 20 year planning period. The number and scale of projects associated with the Master Plan Alternative are greater than that for the No Action Alternative. Under both alternatives, NIH employees, visitors, and neighboring residents will be unavoidably subjected over the long term to construction related impacts such as construction traffic, noise, dust, and campus detours. These impacts would be mitigated by the measures proposed in Section 5.12.

- **Energy Impacts**

Increasing the number of buildings and occupiable floor area for research and clinical facilities as proposed in the Master Plan Alternative, would unavoidably increase energy consumption for heating, cooling, and supplying electric power. Energy consumption would also increase under the No Action Alternative, but to a significantly lower level. Additional energy would be consumed in the construction and demolition processes. New construction provides the opportunity to include many conservation measures in the design and construction of new facilities.

- **Mature Tree Loss**

It is estimated that implementation of the Master Plan would result in the loss of about 500 mature trees on the campus. Over the 20 year planning span, some of these mature trees would be lost to natural attrition.

5.14 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The proposed action is a planning document and does not commit resources irreversibly or irretrievably per se until implementation. If the Master Plan Alternative is implemented in whole or in part, the following resources would be committed:

- Energy

Fossil and nuclear fuels would be committed, either directly or indirectly, to construct, maintain, heat, cool, and power proposed campus facilities. Energy would also be committed for employee transportation, either in vehicles or by public transit.

- Building Materials

Implementation of the proposed action involves commitment of a range of natural and raw materials for construction of facilities. Additionally, large amounts of labor and natural resources are used to fabricate and manufacture construction materials. These materials generally are not retrievable, but recycling of building materials such as copper pipe, metals, and some plastics is increasing. In general, materials needed for construction are not in short supply, and their use will not have an adverse effect upon continued availability of these resources.

5.15 LOCAL SHORT TERM USE AND LONG TERM PRODUCTIVITY

While the proposed Master Plan Alternative would require the use of resources for construction, operation and maintenance, this would be offset by the enhancement of long-term productivity in biomedical research. NIH could continue its legislative mission as a world-class basic and clinical research facility, exploring the causes and cures for diseases and afflictions, both directly on the campus and through its extramural research program. NIH is a key element in the productivity of biomedical research throughout the world. Economic benefits accrue directly through its grant and research programs. Much more importantly, however, nearly every American citizen will benefit in the long term from medical advances made at NIH, or under its auspices in the extramural research program.

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Section Six

Coordination and Comment

6.1 MEETINGS/PUBLIC PARTICIPATION

NIH has conducted a rigorous and active public participation program and consultation with government agencies in developing the Bethesda campus Master Plan and the 2003 update. The program has conformed to the requirements of the Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, U.S. Council on Environment Quality, 1978 as amended; Environmental Policy and Procedures, NCPC, 1979 as amended; and the guidelines given in the Bethesda Chevy Chase Master Plan, M-NCPPC, 1990, for cooperative consultation on prospective growth at NIH.

Through this program, NIH has provided information on concepts, alternatives, and proposed facilities in the Master Plan to government agencies, NIH management and employees, and local citizens. In turn, NIH has sought and given these groups the opportunity to express, and local citizens. In turn, NIH has sought and given these groups the opportunity to express opinions on proposed concepts and plans, ask questions, and identify issues, concerns and potential impacts.

6.1.1 The 1995 Master Plan

The 1995 Master Plan public participation process is detailed in Section 6 of the Final Environmental Impact Statement for the 1995 Master Plan, NIH, 1995. A summary follows. The public participation process began at the earliest stages of project development, NIH circulated a letter of notification to pertinent federal, State, and local review agencies and jurisdictions, elected officials, and citizen associations. The letter noted that a Master Plan for the Bethesda campus would be prepared, that future scoping meetings would be held, and invited comment. Separate scoping meetings were held for government review agencies and local jurisdictions, NCPC and M-NCPPC, NIH employees, and the general public.

As work progressed, over 50 general meetings were held with agencies and the public to coordinate on issues, keep them informed, and involve them in the decision making process. In the initial phase of the project, NIH cooperatively established a NIH Neighbor Council composed of representatives from the residential communities in the environs of the Bethesda campus meeting. Meetings were open to the public, and interested parties or individuals from more peripheral communities had the opportunity to attend. Other organizations in proximity to the campus whose plans and facilities could be directly affected by NIH proposals were also invited to participate.

In September 1994, NIH established an Office of Community Liaison to promote collaboration between NIH and the surrounding communities organizations, and elected officials. Under the auspices of the Office of Community Liaison, 77 community groups and organizations were invited to participate in an expanded citizen participation program for master plan development. A Core Community Working Group was formed from representatives of twenty-four community organizations that chose to actively participate. The remaining communities were kept informed of activities through regular mailings.

Agency liaison members included representatives of the National Capital Planning Commission, the Maryland-National Capital Park and Planning Commission, the Maryland Office of Planning, the Bethesda-Chevy Chase Chamber of Commerce, and Montgomery County Council Staff. The Community Working Group was comprised of a Master Plan core group, and environmental, adjacency/site amenities, and transportation and traffic subgroups, which discussed these issues in greater detail. Many of the early meetings were open to discussion of any topic or issue of concern about NIH and its operations. A series of more than two dozen meetings were held on twelve successive dates, with increasing emphasis on Master Plan development in the

latter half of the participation period. This phase of the public process was instrumental and influential in shaping the 1995 Draft Master Plan Alternative.

NIH received extensive written comment during 1995 Master Plan development. (Final Environmental Impact Statement, Vol. 2 of 2, Correspondence for the 1995 Master Plan, NIH, 1995). Eleven early coordination letters were received in the scoping process. A total of 44 letters were received in response to circulation of the Draft Master Plan and Draft Environmental Impact Statement (EIS), and Draft EIS Supplement. NIH prepared written responses to each comment or question (ibid.).

Section 5(a) of the National Capital Planning Act of 1952, as amended (40 U.S.C. § 71d(a)), provides that each federal agency in the National Capital Region shall advise and consult with the National Capital Planning Commission (NCPC) in the preparation of master plans and programs which can affect the Comprehensive Plan for the National Capital. If the installation is in the Maryland portion of the National Capital Planning Region, then the Maryland-National Capital Park and Planning Commission (M-NCPPC) acts as an advisory capacity to NCPC.

The 1995 Bethesda campus Master Plan and environmental documentation went through the NCPC/M-NCPPC review process. In its review of draft documents, NCPC noted in its comments to NIH that the 1995 Master Plan submitted by NIH:

“...represents a thorough and comprehensive planning effort. The Commission commends the NIH master planning team for its creative and practical framework which will guide new development while enhancing the campus-wide physical setting. We believe that implementation of the Master Plan will result in a superior design and a greatly improved functional arrangement of buildings, circulation, and landscaping.

In many ways, this Master Plan serves as a model for other federal installations to follow. The Master Plan and supporting technical reports are among the highest quality ever submitted to the Commission. The text is clear and concise, and abundantly illustrated with maps, sketches, and photographs. In substance, the documents are also exemplary.”

The Commission also noted:

“The Commission appreciates your substantial effort to encourage community involvement in the development of the Master Plan. Your efforts stand as a good example of federal cooperation with neighboring communities and local jurisdictions. Your extensive community outreach program has been quite successful in building trust and goodwill between NIH and the community. This is particularly significant in light of the difficult relationship of only a few years ago. Particularly noteworthy is the willingness of NIH to change aspects of the Master Plan in response to suggestions and concerns expressed by community representatives and planning agencies’ staff participating the Master Plan Working Group.”

In accordance with 42 U.S.C. 4332(2)(c), NIH held more formal meetings that were advertised in the local newspaper and open to the general public. Approximately 70 people attended a public hearing on the 1993 Draft Master Plan held at 7 PM in December 1993, in the Clinical Center Mazur Auditorium on the NIH Bethesda campus. NIH representatives were on hand prior to the hearing to informally receive comments, explain the project, and answer questions on a one-on-one basis. Brief presentations were made by NIH representatives on the programmatic interviews used to project future NIH employee and space needs; the Master Plan and the process used to derive it; and a summary of the MOU, traffic, noise impacts and mitigation. Seventeen citizens representing community organizations or themselves presented comments.

Approximately 50 people attended a public hearing on the 1995 Draft Master Plan and associated Draft EIS Supplement in September 1995. The hearing was held at 7:30 PM in the Natcher Building Auditorium on the NIH Bethesda campus. NIH representatives were on hand from 5:30 to 7:30 PM prior to the hearing to informally receive comments, explain the project and specific features of interest, and answer questions on a one-on-one basis with citizens. Brief presentations were made on the community participation process used in development of the project, Master Plan planning premises, the principal proposals with the Master Plan, and subsequent NEPA review and project approval schedule. Three citizens representing community organizations or themselves gave oral testimony and comment.

6.1.2 Master Plan Update

The public involvement program has continued since 1995. In the interim, NIH has implemented or is in the process of implementing projects proposed in the 1995 Master Plan. When applicable, NEPA documentation has been prepared for these projects. Review agencies, local jurisdictions, elected officials, and the NIH Community Liaison Council have been involved with review of these projects as they pass through the implementation process. As a result, they are familiar with campus conditions and NIH plans and projects.

The Master Plan 2003 update is primarily revision of the 1995 Master Plan accounting for interim changes. For this and the above reasons, no formal scoping meetings were held. Jurisdictional and review agency scoping was accomplished by letter to an updated list of recipients derived from the 1995 Master Plan FEIS distribution list. The local community was informed that the project was underway through the Office of Community Liaison newsletter, the OCL Update, and by presentation to the Community Liaison Council on June 21, 2001. Community associations or individuals not currently affiliated with the Community Liaison Council were invited to participate in the planning process.

NIH has not received any written comment in response to the scoping or early coordination process.

NIH held kick off or scoping meetings with NCPC and M-NCPPC staff on June 4 and June 18, 2001, respectively. NIH representatives informed the staffs that the Master Plan Update was starting. A brief presentation was made at each meeting on future site employee projections as derived from programming with NIH Institute, Center, and Division leadership. The commission staffs asked a number of general questions, but had no substantive comment on issues or requirements. The same presentation was made to the Community Liaison Council at their monthly meeting on June 21, 2001.

As part of its ongoing public involvement program, NIH has established three working groups which bring the community into the planning process. Each is composed of NIH representatives, interested citizens, and community organizations. The three groups are devoted to three broad areas of interest as defined by citizen members: Environmental Impacts, and Transportation, and Construction issues. Each group held a series of meetings between July and November, 2001. To ensure participation and provide a deeper understanding of planning issues, information was presented on existing conditions, analytical methods, and potential resultant impacts for discussion.

Topics covered by the Environment Impact Working Group included the perimeter buffer, campus trees, cultural assets, wastes, utility systems and demands, stormwater management, traffic noise and air quality, and power plant noise and air quality. The Transportation Working Group discussed vehicle traffic, transit, parking, and transportation management, not only as it related to the NIH Bethesda campus itself, but also to the Bethesda Central Business District and Bethesda-Chevy Chase planning area. Discussions in the Construction Impact Working Group centered on construction truck traffic, and construction dust

and noise impacts.

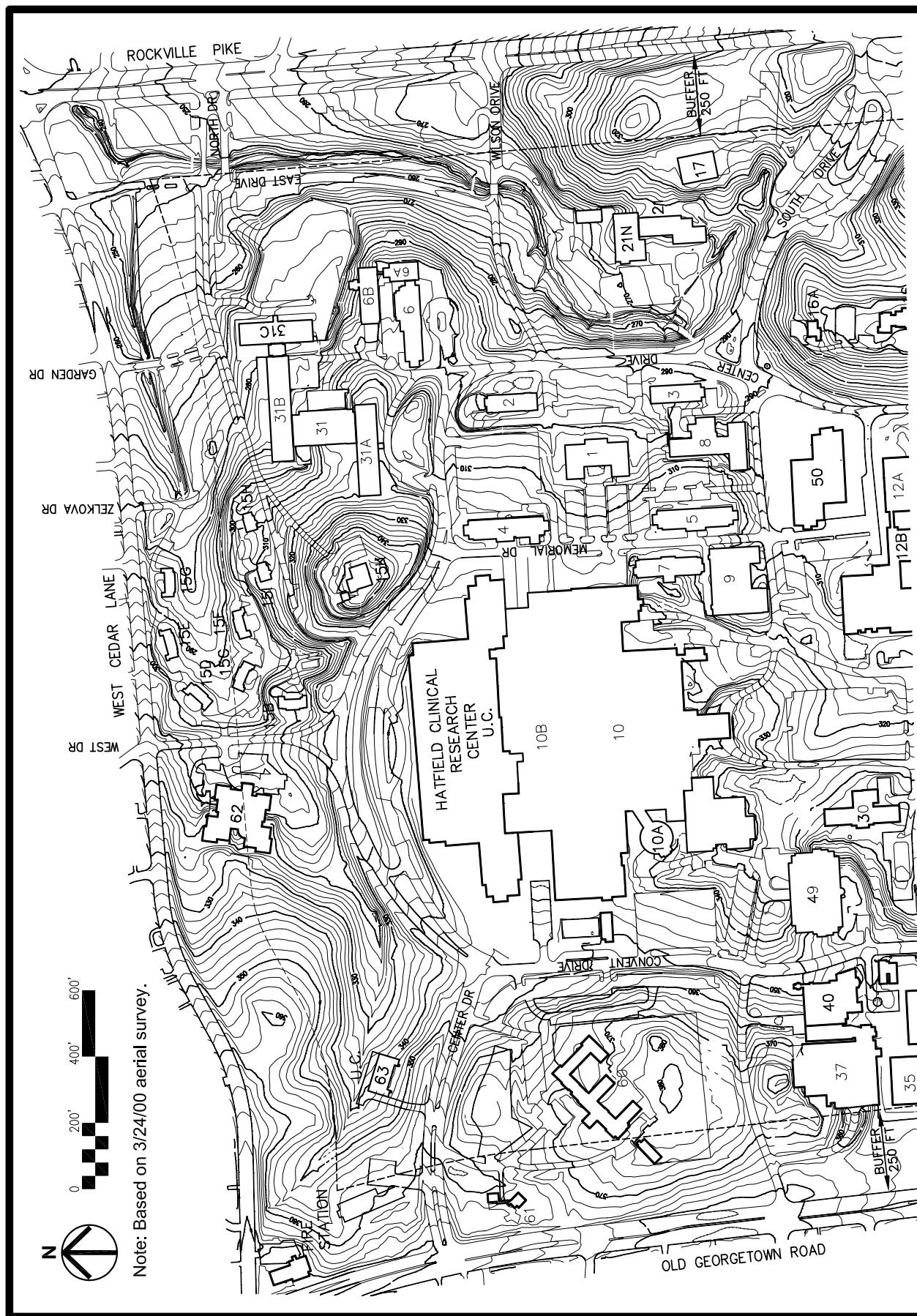
Publication of the Draft Master Plan and EIS Supplement was originally scheduled for October 2001. National events in the previous month put the plan on hold. Much of the intervening period was used to identify, develop, and evaluate measures that would be necessary at NIH Bethesda to respond to the past September 2001 environment. Once the measures were established conceptually, their effects on the Master Plan were evaluated, and the Draft Master Plan revised accordingly.

The Environmental Impact and Transportation Working Groups met in October 2002 to discuss the changes in impacts generated by the revised plan. Presentations summarizing the changes were made to the Community Liaison Council at their monthly meetings on October 25, 2002 and March 20, 2003. Representatives of the M-NCPPC and NCPC staffs were invited to the meetings.

— † † † —

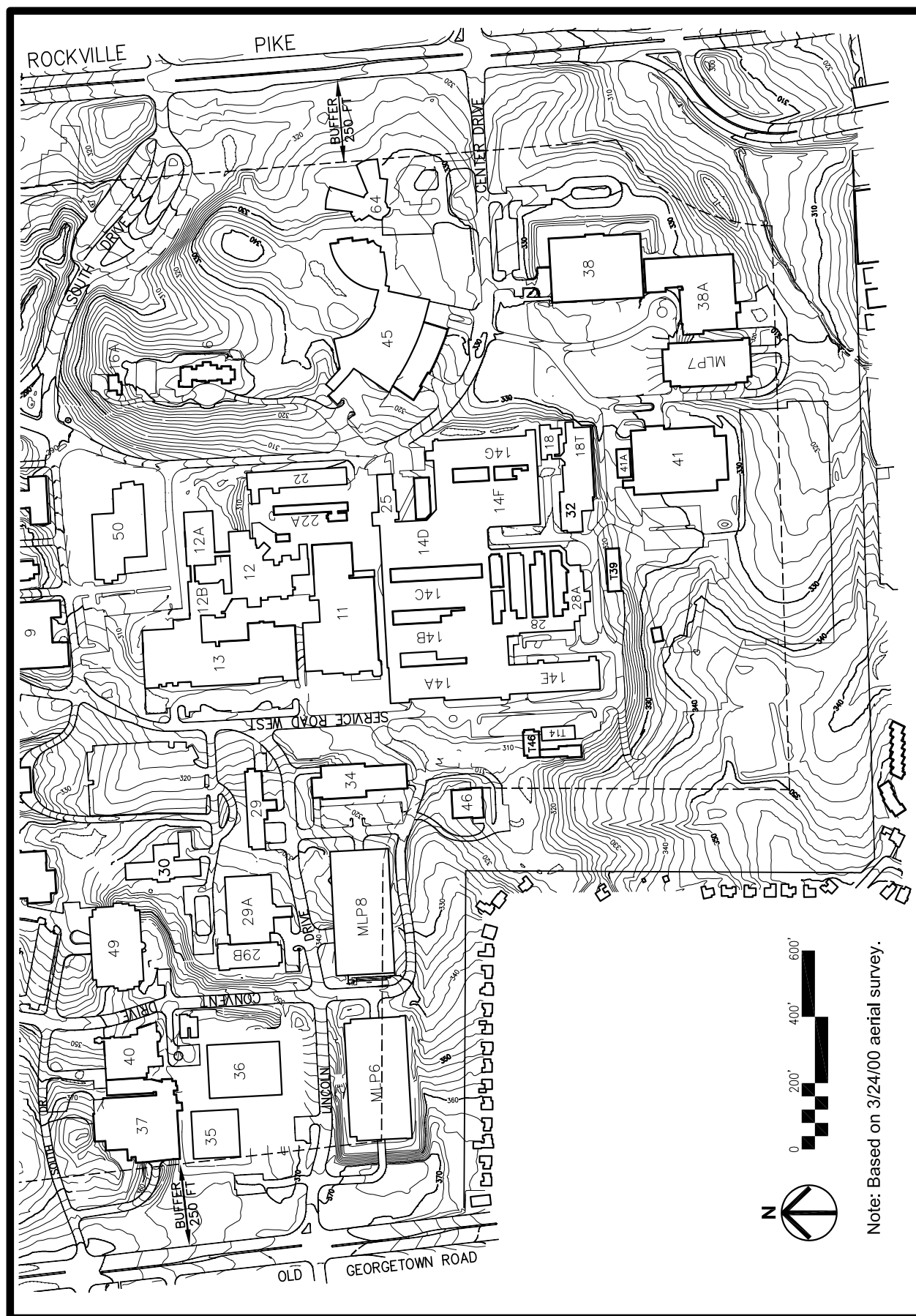
Appendix A

Site Maps



Note: Based on 3/24/00 aerial survey.

FIGURE A-1 EXISTING SITE - NORTH HALF.



Appendix B

Master Plan 2003 Update Schematic

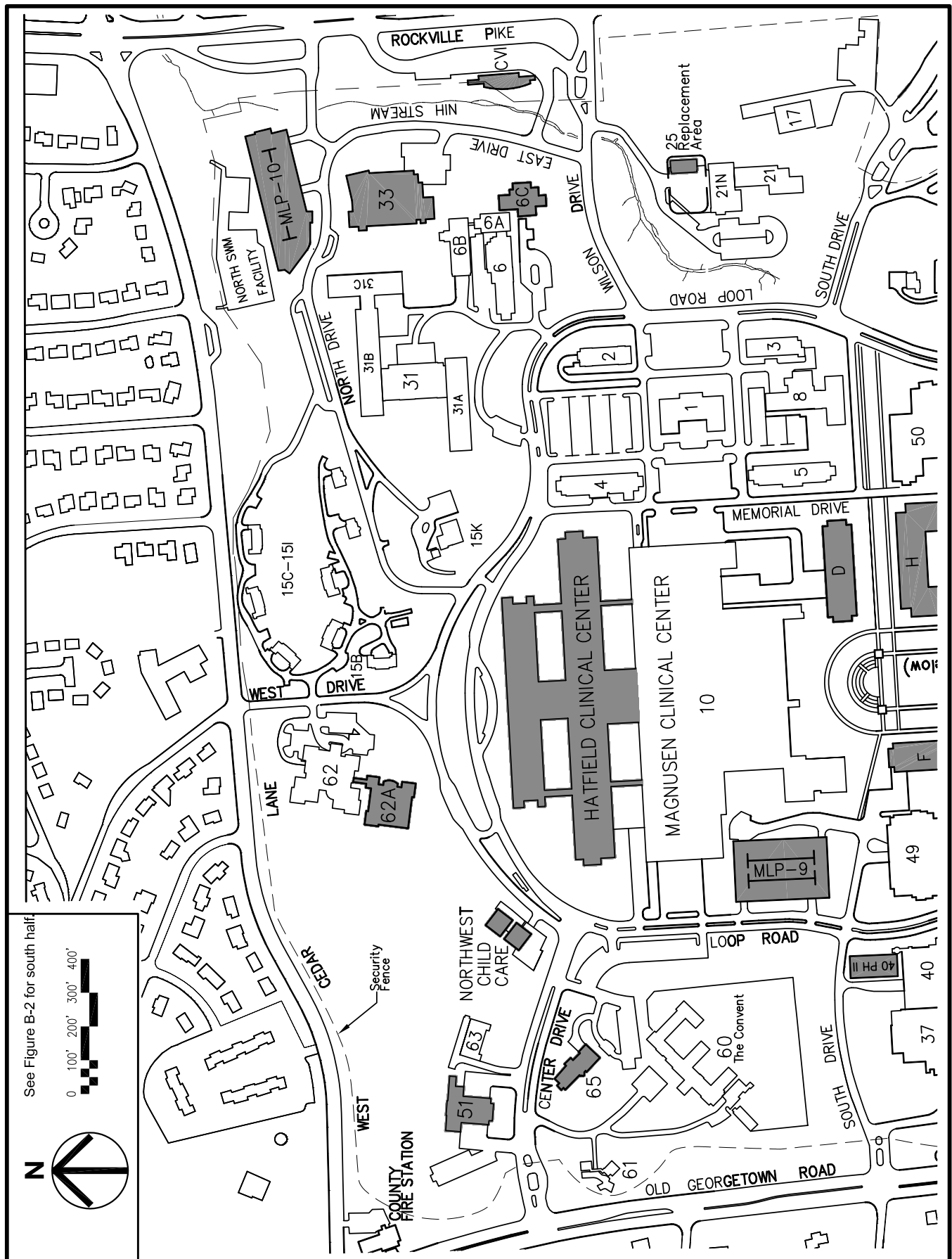


FIGURE B-1 MASTER PLAN SCHEMATIC - NORTH HALF.

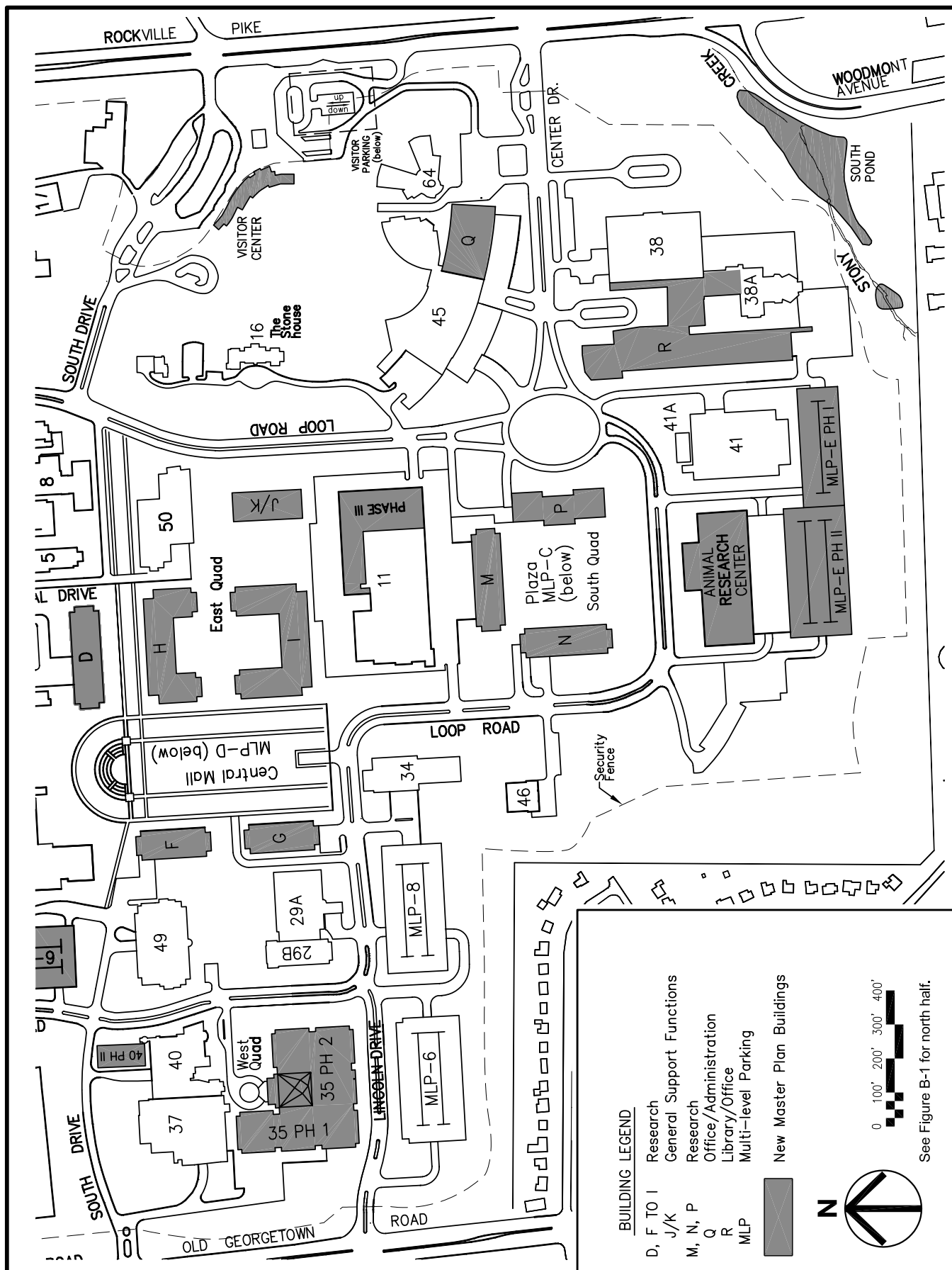


FIGURE B-2 MASTER PLAN SCHEMATIC - SOUTH HALF.

NCPC-MCPB-NIH Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING
BY AND AMONG THE
NATIONAL CAPITAL PLANNING COMMISSION,
THE MONTGOMERY COUNTY PLANNING BOARD OF THE
MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION,
AND THE NATIONAL INSTITUTES OF HEALTH

This memorandum of understanding (MOU) sets forth the agreement among the National Capital Planning Commission (NCPC), the Montgomery County Planning Board of the Maryland-National Capital Park and Planning Commission (MCPB), and the National Institutes of Health (NIH) regarding implementation of a Transportation Management Plan (TMP) for the NIH Bethesda Campus.

WHEREAS, the Comprehensive Plan for the National Capital urges that parking facilities at Federal facilities be provided and managed at a level which assumes maximum use of public transportation and high-occupancy vehicles.

WHEREAS, NCPC's Project Plans Submission Requirements require that sponsoring agencies' TMPs incorporate the following:

- o descriptions of existing and proposed peak hour traffic by mode
- o summary of existing and proposed parking by type and assignment
- o goals for trip reduction, modal split, and vehicle occupancy
- o strategies to minimize vehicle work trips and discourage single-occupancy commuting
- o discussion of projected transportation impacts and description of mitigation measures
- o description of applicable local, state, and regional transportation management requirements and recommendations for implementation
- o measures for monitoring and adjustment

WHEREAS, NIH has prepared a TMP that established program goals and short-term and long-term implementation strategies.

WHEREAS, on December 19, 1991, the MCPB recommended that NCPC defer action on the proposed parking garage and temporary parking lots located at the NIH Bethesda campus, until NIH satisfies the conditions and concerns identified in the MCPB staff memorandum of December 16, 1991, including a condition that NIH, NCPC, and MCPB execute an agreement to implement the TMP.

WHEREAS, the NCPC, on January 9, 1992, approved the preliminary plans for the garage and temporary lots with a request that NIH work with NCPC and MCPB to resolve outstanding issues related to the TMP including the establishment of a formal agreement respecting implementation of TMP strategies.

WHEREAS, on February 18, 1992, NIH, NCPC, and MCPB agreed to meet on a regular basis to exchange transportation, planning, and demographic information for the mutual benefit of all.

IT IS THEREFORE AGREED THAT:

1. NIH, NCPC, and MCPB will meet at a minimum of two times per year to discuss⁽¹⁾ updated planning, master planning, project development, and transportation information, as well as outstanding issues that need to be resolved.
2. NIH commits itself to undertake its best faith effort to implement the TMP strategies in order to achieve TMP goals, and will take appropriate action regarding funding strategies. (TMP goals and strategies are listed in the attached Addendum.) To this end, NIH will monitor the success of the TMP strategies already implemented by providing NCPC and MCPB with quarterly traffic counts and annual evaluations. This data will be used in conjunction with supplementary transportation data such as the number of employees and visitors using public transportation, carpools, and vanpools, etc. to determine the overall effectiveness of the TMP in preventing additional NIH-generated peak hour traffic on roadways which serve the campus.
3. Consistent with this MOU and the NIH master plan, NIH will assess the need for parking associated with proposed future growth and attempt to reduce the future parking demand to the extent practicable.
4. NCPC and MCPB will evaluate the proposed future employment and parking growth at the NIH Bethesda campus in light of NIH's success in implementing TMP strategies and achieving TMP program goals.
5. NIH will implement other measures as appropriate, upon consultation with NCPC and MCPB, if current strategies prove unsuccessful.

THE NATIONAL INSTITUTES OF HEALTH

By: Bernadine Healy MAY 14 1992
Bernadine Healy, M.D. Date
Director

THE MONTGOMERY COUNTY PLANNING BOARD OF THE MARYLAND-
NATIONAL CAPITAL PARK AND PLANNING COMMISSION

By: Gus Bauman 5/24/92
Gus Bauman Date
Chairman

THE NATIONAL CAPITAL PLANNING COMMISSION

By: Glen T. Urquhart _____
Glen T. Urquhart Date
Chairman

ADDENDUM

GOALS OF THE NIH BETHESDA CAMPUS TRANSPORTATION MANAGEMENT PROGRAM

1. Improve the availability of parking spaces on campus for NIH personnel and visitors.
2. Mitigate the traffic impacts of further campus development on the roadways serving the NIH campus (such that the level of congestion along the roadways serving NIH is made no worse than if such development did not occur).
3. Maintain a "good neighbor" relationship with the surrounding community.

SHORT-TERM STRATEGIES

1. Establish an Employee Transportation Services Office to coordinate TMP strategies and promote non-single occupant travel modes by employees.
2. Continue to place carpool, vanpool, handicapped, and visitor parking in close proximity to the intended destination of the users. Disincentives will be enacted to discourage violation of carpool regulations.
3. Implement a transit discount program for employees up to the maximum tax-free benefit allowable by law, and initiate a request for legislative action to allow parking and ticketing revenues and/or appropriated funds to be used by NIH to make such a program self-sustaining.
4. Improve NIH campus shuttle bus service as demand warrants and provide adequate covered waiting areas at or near shuttle bus stops, where possible.
5. Implement a comprehensive campus-wide re-signage for vehicles and pedestrians, including a study of internal safety signage and signaling.
6. Emphasize parking regulation enforcement by providing an adequately staffed parking enforcement work force and provisions to minimize off-campus parking.
7. Further promote the use of flexitime and flexitour by employees. Reserve selected parking areas for later-arriving employees to encourage use of flexitime.
8. Have the employee transportation office publicize existing programs which utilize outlying parking areas, such as church lots and park-and-ride areas.
9. Institute pay parking for visitors to NIH, exclusive of patients and blood donors, except after normal working hours.

LONG-TERM STRATEGIES

1. As the campus develops, maintain the parking supply at no greater than 0.5 spaces per NIH employee, plus additional parking spaces to serve the parking needs of visitors and patients at NIH. In determining a parking supply, and applying a ratio not to exceed 0.5 spaces per employee, the number of employees used in this calculation should be no greater than the maximum employment level of the approved master plan.
2. Within the context of the development of the NIH master plan -the parking requirements associated with future campus growth and the reestablishment of the buffer zone surrounding the campus should be accommodated by the construction of multi-level parking (MLP) structures, within the parking supply criteria adopted by NIH. Planning and funding for these new MLP's should be linked to the funding plans for other buildings to be added to the campus.
3. Implement an internal loop road circulation system within the NIH campus, with two-way traffic.
4. Improve congested roadway intersections through the addition of more turning lanes to selected intersections adjacent to the NIH campus to mitigate traffic congestion. The Employee Transportation Services Office will coordinate with appropriate County and State agencies to determine funding strategies, design implications, timing, and implementation requirements.
5. Have the Employee Transportation Services Office explore the feasibility of developing or leasing satellite parking areas near outlying Metrorail Red Line stations to serve NIH employees.
6. NIH will continue to explore alternative strategies, and if all strategies fail to achieve the stated TMP goals, pay parking for employees will be instituted as a last resort.

Appendix D

List of Preparers and Reviewers

LIST OF PREPARERS AND REVIEWERS

List of Preparers

Name: Frederick M. Heider
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Firm: Athavale, Lystad & Associates
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Firm: SmithGroup
Experience: 29 years experience in master planning and urban design
Items: Master Plan concepts and alternatives

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Items: Historic

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Position: Senior Project Manager
Firm: Patton Harris Rust and Associates
Experience: 17 years experience in civil engineering and planning
Items: Utility planning, stormwater management


**DISCLOSURE STATEMENT FOR
CONTRACTORS PREPARING
ENVIRONMENTAL IMPACT STATEMENTS
FOR THE
NATIONAL INSTITUTES OF HEALTH
MASTER PLANS**

I, Tewolde A. Iyob, am the President of Athavale, Lystad & Associates, Inc. ("Contractor"), a contractor responsible for the preparation of the Environmental Impact Statements associated with the NIH Master Plans for the National Institutes of Health.

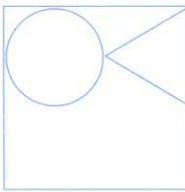
Pursuant to the requirements of 40 C.F.R. 1506.5(c), I hereby certify that:

- (1) I am an officer of the above-listed Contractor and have full authority to sign this certification on behalf of the Contractor and thereby bind the Contractor to the statements made herein;
- (2) At this time, the Contractor has no financial or other interest in the outcome of the NIH Master Plans and is committed only to providing NIH with quality professional services in support of NIH project goals;
- (3) The above information is true and correct to the best of my knowledge and belief.

Made this 20th day of JULY, 2004.



Tewolde A. Iyob, President
Athavale, Lystad & Associates, Inc.



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**DISCLOSURE STATEMENT FOR
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ENVIRONMENTAL IMPACT STATEMENTS
FOR THE
NATIONAL INSTITUTES OF HEALTH
MASTER PLAN**

I, Stuart L. Knoop, FAIA, am the Vice President of Oudens + Knoop Architects PC ("Contractor"), a contractor responsible for the preparation of the NIH Master Plan 2003 Update and the accompanying Environmental Impact Statements for the National Institutes of Health.

Pursuant to the requirements of 40 C.F.R. 1506.5(c), I hereby certify that:

- (1) I am an officer of the above-listed Contractor and have full authority to sign this certification on behalf of the Contractor and thereby bind the Contractor to the statements made herein;
- (2) At this time, the Contractor has no financial or other interest in the outcome of the NIH Master Plans and is committed only to providing NIH with quality professional services in support of NIH project goals;
- (3) The above information is true and correct to the best of my knowledge and belief.

Made this 22nd day of July, 2004



Stuart L. Knoop, FAIA, Vice President, Oudens + Knoop Architects PC

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Appendix F

Abbreviations and Acronyms

ABBREVIATIONS AND ACRONYMS

A

@	at
AAALAC	American Association for Accreditation of Laboratory Animal Care
AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council for Historic Research
ACRF	Ambulatory Care Research Facility
ACT	Association for Commuter Transportation
AGP	Annual Growth Policy
AIA	American Institute of Architects
AICP	American Institute of City Planners
AIDS	Acquired Immunodeficiency Syndrome
ALT	Alternative
ANSI	American National Standards Institute
AP0	Average Passenger Occupancy
AQCA	Air Quality Control Area
ATMP	Additional Transportation Management Program (measures)
Avg.	Average

B

BCC	Bethesda Chevy Chase
BCC CAB	Bethesda Chevy Chase Citizens Advisory Board
BEIP	Biomedical Engineering and Instrumentation Program
BOD5	5-day Biological Oxygen Demand
BP	Before Present
BPY	British Thermal Units per Year
Brdg.	Bridge
BTU	British Thermal Units
BTU/CF	British Thermal Units per Cubic Foot
BTU/GAL	British Thermal Units per Gallon
BTU-HR/TON	British Thermal Units Hours per Ton
BTU/KW-HR	British Thermal Units per Kilowatt Hour
BTU/SF/F/HR	British Thermal Unit per Square Foot per Degree Fahrenheit per Hour
BTU/YR	British Thermal Units per year

C

°C	degrees Celsius
CAA	Clean Air Act
Cap.	Capacity
CAS No.	Chemical Abstract Service number
CBD	Central Business District
CC	Clinical Center
CEQ	Council on Environmental Quality
CF/HR	Cubic feet per hour

CFR	Code of Federal Regulations
cfs	Cubic feet per second
CF/YR	Cubic feet per year
CIP	Capital Improvement Plan
CLRP	Constrained Long Range Plan (for regional transportation planning)
CLV	Critical Lane Volume
CMS	Congestion Management System
CMSA	Consolidated Metropolitan Statistical Area
CO	Carbon monoxide
COG	Metropolitan Washington Council of Governments
COGEN	Cogeneration
con't.	continued
COMAR	Code of Maryland
CRDS	Chemical Recycling and Disposal Service
CSX	CSX Transportation

D

dba	A-weighted decibels
dbh	diameter at breast height
D.C.	District of Columbia
DEIS	Draft Environmental Impact Statement
DEP	Division of Environmental Protection
DEPC	Division of Emergency Preparedness and Coordination
DES	Division of Engineering Services
DFP	Division of Facilities Planning
DFRS	Division of Fire and Rescue Services
DOHS	Division of Occupational Safety and Health
DP	Division of Police
DPS	Division of Public safety
DPW&T	Department of Public Works and Transportation
DRS	Division of Radiation Safety
DS	Division of Safety
DSO	Division of Security Operations
Dist. Oil	Distillate oil, No. 2 fuel oil
DRG	Division of Research Grants

E

E.	east
EAC	External Advisory Committee
EB	eastbound
e.g.	for example
EIS	Environmental Impact Statement
EMB	Emergency Management Branch
EMS	Emergency Maintenance and Safety Program
EPA	Environmental Protection Agency
EPB	Environmental Protection Branch
ERH	Emergency Ride Home Program

ETSO Employee Transportation Service Office

F

°F degrees Fahrenheit
Fac. facility
FAES The Foundation for Advanced Education in the Sciences
FAR floor to land area ratio
FCP Forest Conservation Plan
FDA Food and Drug Administration
FEMA Federal Emergency Management Agency
FGR Fuel Gas Recirculation
FHWA Federal Highway Administration
FIC Fogarty International Center
FPP Forest Protection Plan
FPPB Facilities Planning and Programming Branch
FSD Forest Stand Delineation
ft. feet
FY Fiscal Year

G

GAL gallons
Gal/Hr gallons per hour
GAO General Accounting Office
GPD gallons per day
gpm gallons per minute
GSA General Services Administration
gsf gross square feet

H

HCl Hydrochloric Acid
HIV Human Immunodeficiency Virus
HOV High Occupancy Vehicle
HR hour
hz hertz

I

IC's Institutes and Centers
i.e. Id est (that is)
IMIP Infrastructure Modernization and Improvement Program
Inc. Incorporated
IRG's Initial Review Groups
ISMP Institutional Stormwater Management Plan
ISTEA Intermodal Surface Transportation Efficiency Act

J

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K

KMCM	Keep Montgomery County Moving
KPMG	KPMG Peat Marwick
KPPH	1,000 pounds per hour
KV	Kilovolt
KVA	Kilovolt-amps
KW	Kilowatt
KWH	Kilowatt hour

L

lb/1000 sf/day	pounds per 1,000 square feet per day
lb/hr	pounds per hour
lbs/sq. ft.	pounds per square foot
lb/yr	pounds per year
Ld	daytime noise levels
Ldn	day-night noise level
Leq	equivalent noise level
Ln	nighttime noise levels
Ln.	Lane
LSM	Laboratory of Statistical and Mathematical Methodology

M

MARC	Maryland Rail Commuter
Max	Maximum
MBTU	million British Thermal Units
MBTU/YR	million British Thermal Units per year
MCDEP	Montgomery County Department of Environmental Protection
MC DOT	Montgomery County Department of Transportation
MCPB	Montgomery County Planning Board
MCTMO	Medical Center Transportation Management Organization
MD	Maryland
MD DOT	Maryland Department of Transportation
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MEV	million electron volt
MGD	million gallons per day
mg/l	milligrams per liter
MHT	Maryland Historic Trust
mi	miles
Misc.	miscellaneous
MLP	Multilevel parking structure

M-NCPPC	Maryland National Park and Planning Commission
Mngmt.	management
MOU	Memorandum of Understanding
MP	Master Plan
MPN/100ml	Most probable number per 100 milliliters
MPW	medical/pathological waste
MRI	magnetic resonance imaging
MSDS	Material Safety Data Sheet
MUP	Master Utilities Plan
MVA	Million volt-amps
MWAQC	Metropolitan Washington Air Quality Committee
MWCOG	Metropolitan Washington Council of Governments

N

N.	north
NAAQS	National Ambient Air Quality Standards
NAD	non-auto driver
NB	Northbound
NCHGR	National Center for Human Genome Research
NCI	National Cancer Institute
NCI AQCR	National Capital Interstate Air Quality Control Area
NCPC	National Capital Planning Commission
NCRR	National Center for Research Resources
NE	northeast
NEI	National Eye Institute
NEPA	National Environmental Policy Act
NHLBI	National Heart, Lung and Blood Institute
NHPA	National Historic Preservation Act
NIA	National Institute on Aging
NIAAA	National Institute on Alcohol Abuse and Alcoholism
NIAID	National Institute of Allergy and Infectious Diseases
NIAMS	National Institute of Arthritis and Musculoskeletal and Skin Diseases
NICHD	National Institute of Child Health and Human Development
NIDA	National Institute on Drug Abuse
NIDDK	National Institute of Diabetes and Digestive and Kidney Diseases
NIDR	National Institute of Dental Research
NIEHS	National Institute of Environmental Health Sciences
NIGMS	National Institute of General Medical Sciences
NIH	National Institutes of Health
NIHAC	NIH Animal Center, Poolesville
NIMH	National Institute of Mental Health
NINCD	National Institute on Deafness and Other Communication Disorders
NINDS	National Institute of Neurological Disorders and Stroke
NINR	National Institute for Nursing Research
NLM	National Library of Medicine
NMC	Naval Medical Command
NNMC	National Naval Medical Center
NNW	north-northwest
NO ₂	nitrogen dioxide

NO _x	nitrogen oxides
No.	number
NPDES	National Pollution Discharge Elimination System
NRI	National Resources Inventory
NRC	Nuclear Regulatory Commission
NSF	net square feet

O

O ₃	Ozone
OAR	Office of AIDS Research
OC	Office of Communications
ODP	Office of Disease Prevention
OEO	Office of Equal Opportunity
OER	Office of Extramural Research
OFP	Office of Facility planning
OIR	Office of Intramural Research
OM	Office of Management
OPT.	option
ORMH	Office of Research on Minority Health
ORWH	Office of Research on Women's Health
ORS	Office of Research Services
OSHA	U.S. Occupational Safety and Health Administration
OSHB	Occupational Safety and Health Branch
OSPTT	Office of Science Policy and Technology Transfer

P

Pb	lead
PC	page F-1
PCB's	polychlorinated biphenyls
pCi/L	picocuries per liter
PCT	percent
P.E.	Professional Engineer
PEPCO	Potomac Electric Power Company
pH	unit of acidity
Pkwy.	Parkway
PM ₁₀	inhalable particulate matter (10 micron or less)
PMB	Program Management Branch
PPH	Pounds per hour
Ppm	parts per million
PSL	Physical Sciences Laboratory
PWB	Public Works Branch

Q

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R

RACT	Reasonably Available Control Technology
RAT	Recycling Action Teams
REF	reference
Requ.	required
Rd.	Road
Res. Oil	Residual oil, No. 6 oil
ROW	right-of-way
RPP	residential parking permit
RSB	Radiation Safety Branch
RVP	Reid Vapor Pressure
RWS	Radioactive Waste Service

S

S.	South
SB	southbound
SCID	Severe Combined Immunodeficiency
SCS	Soil Conservation Service
sec.	second
sf	square feet
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan (for air quality)
SO ₂	sulfur dioxide
SOV	single occupancy vehicle
SPB	Special Projects Branch
sq. ft.	square feet
SWM	Stromwater Management

T

T	temperature
TAPS	toxic air pollutants
TDL	Target Demand Level
TMA	Transportation Management Area
TMD	Transportation Management Department
TMP	Transportation Management Plan
ton/yr	ton per year
TPP	Tree Protection Plan
TPY	tons per year
TTO	Total toxic organics

U

UB	urban land
µg/m ³	micrograms per cubic meter

μmho/cm	micromhos per centimeter
U.S.	United States
U.S.C.	United States Code
USDA	United States Department of Agriculture
USGS	U.S. Geology Survey
USUHS	Uniformed Service University of the Health Sciences

V

V	Volt
VA	Department of Veteran Affairs
VA	Virginia
VEH.	vehicle
VOC	Volatile Organic Compounds
Vol.	volume
VRP	Veterinary Resources Program

W

W.	west
w/	with
WB	westbound
WMATA	Washington Metropolitan Area Transit Authority
WMS	Waste Management Section
WOPR	White Office Paper Recycling Program
WSSC	Washington Suburban Sanitary Commission

X, Y, Z

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—† † †—

Appendix G

Traffic Data

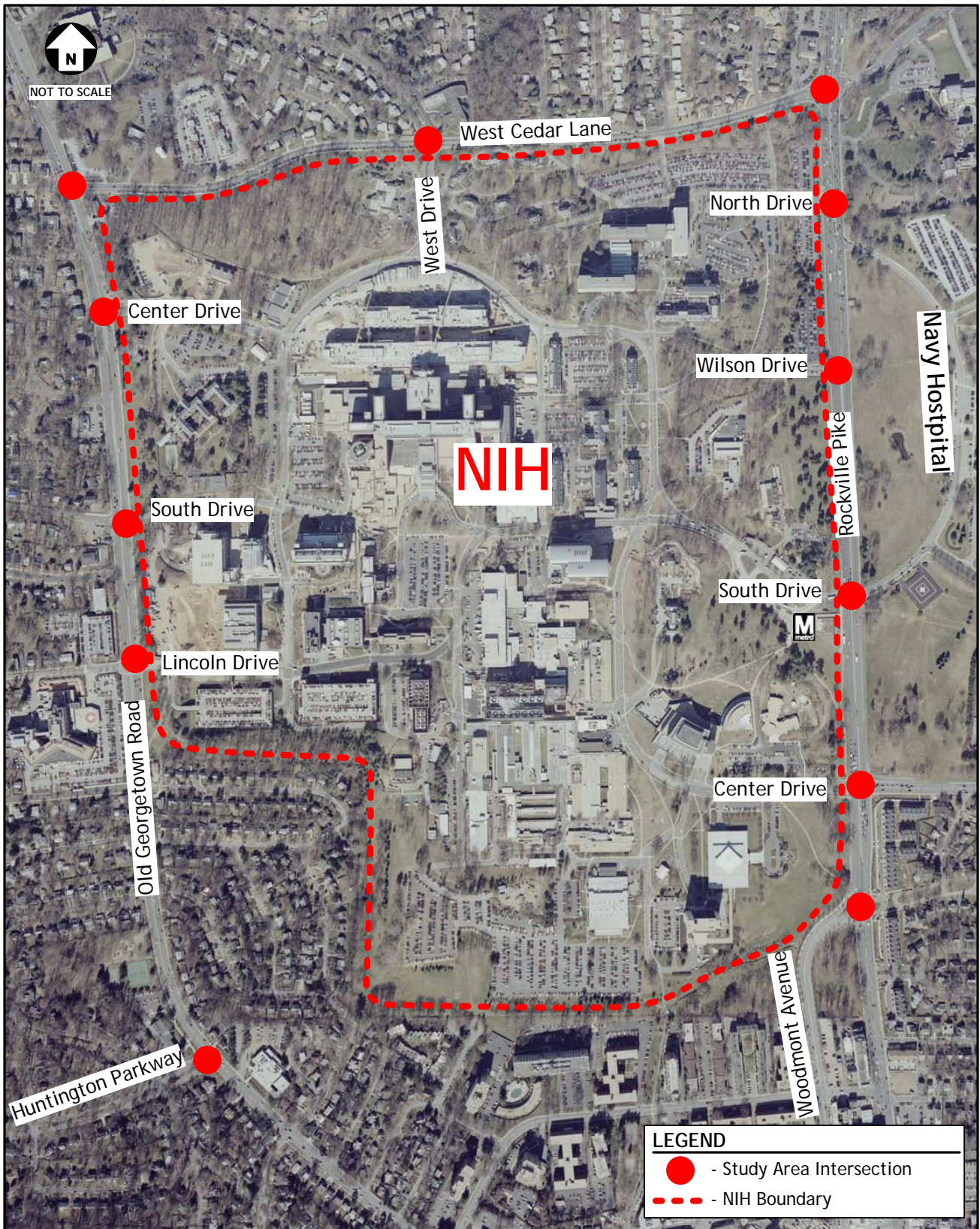


FIGURE G-1 SITE LOCATION AND STUDY AREA INTERSECTIONS.

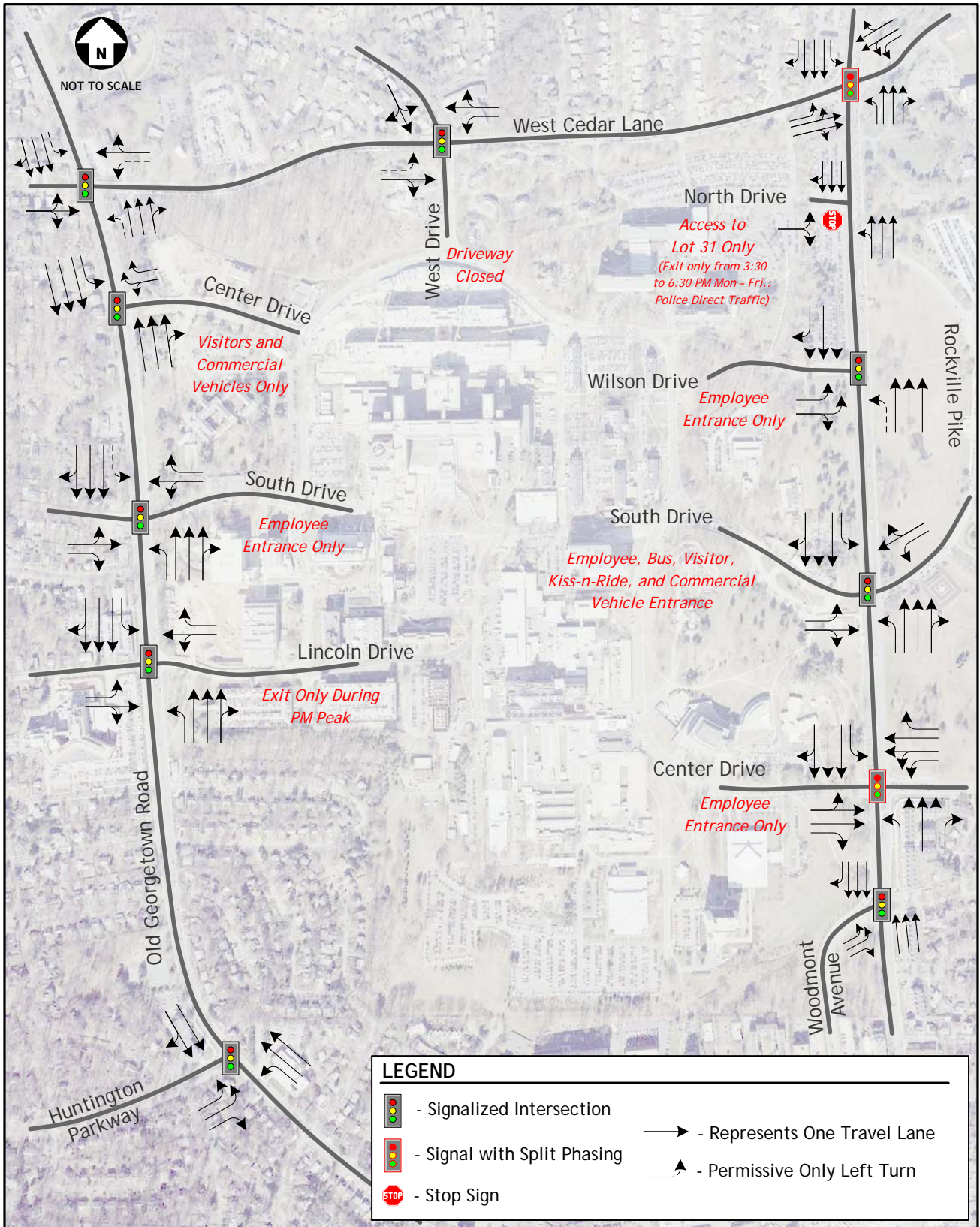


FIGURE G-2 EXISTING LANE CONFIGURATION AND TRAFFIC CONTROL DEVICES.

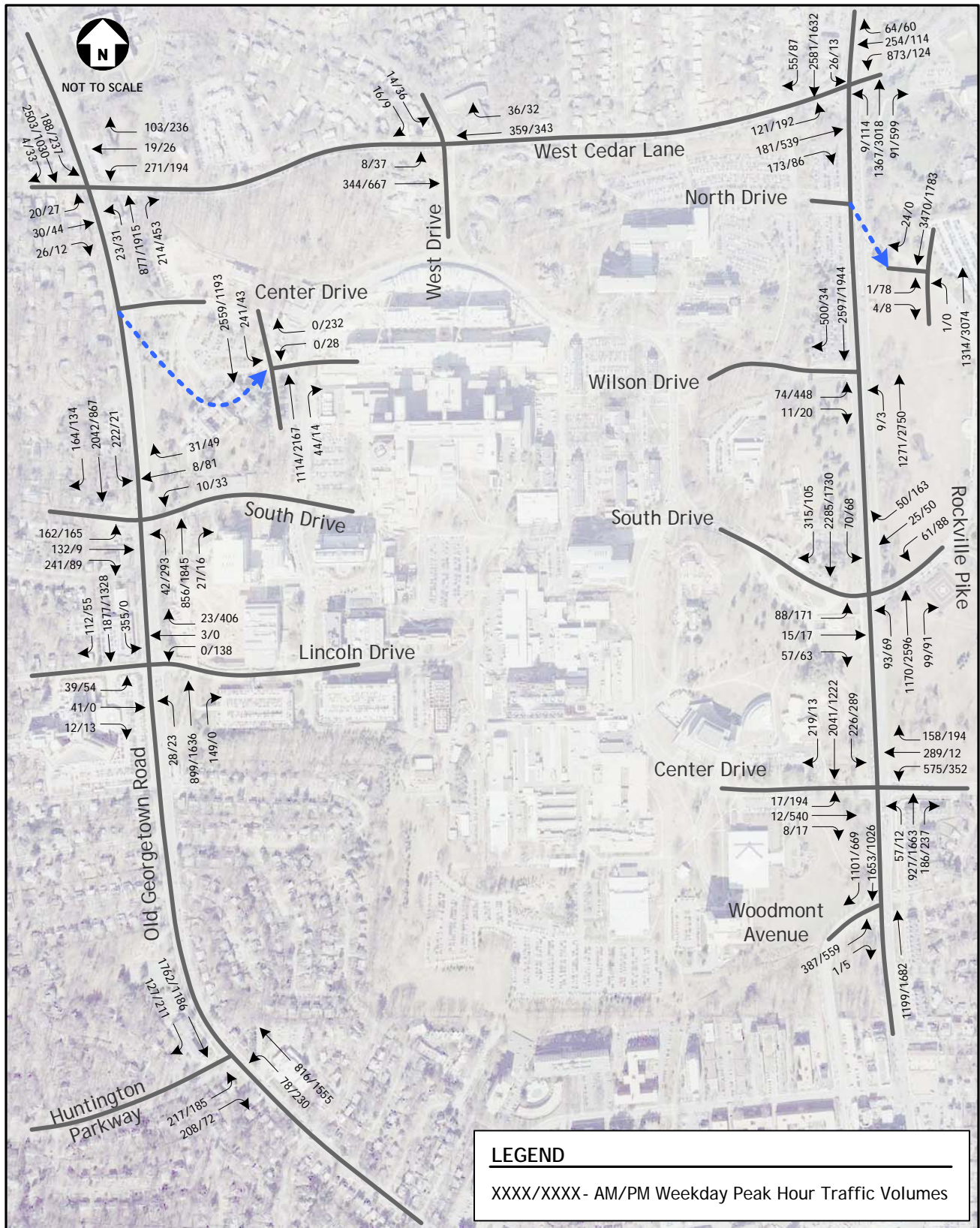


FIGURE G-3 EXISTING PEAK HOUR TRAFFIC VOLUMES.

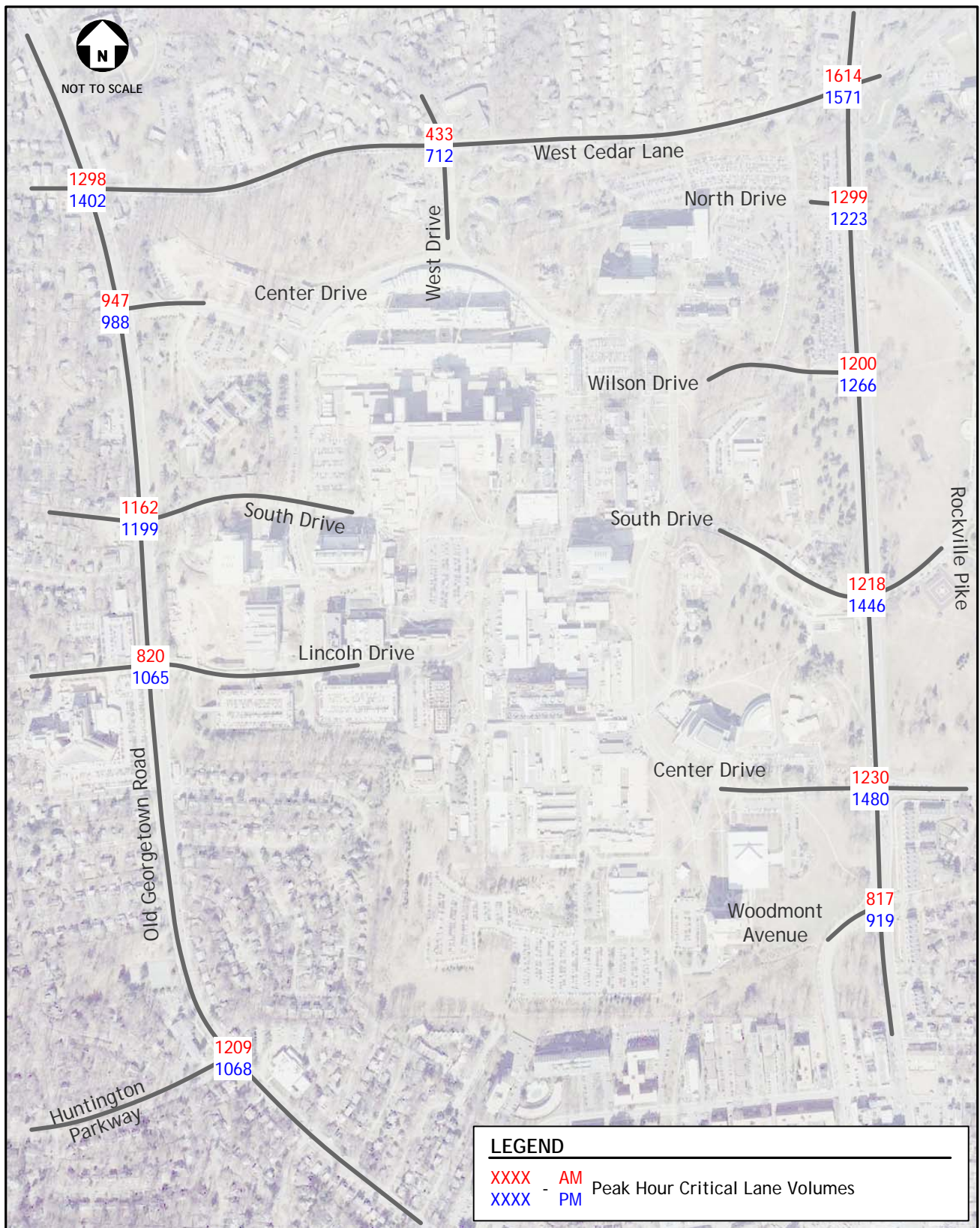


FIGURE G-4 EXISTING AM/PM PEAK HOUR CRITICAL LANE VOLUMES.

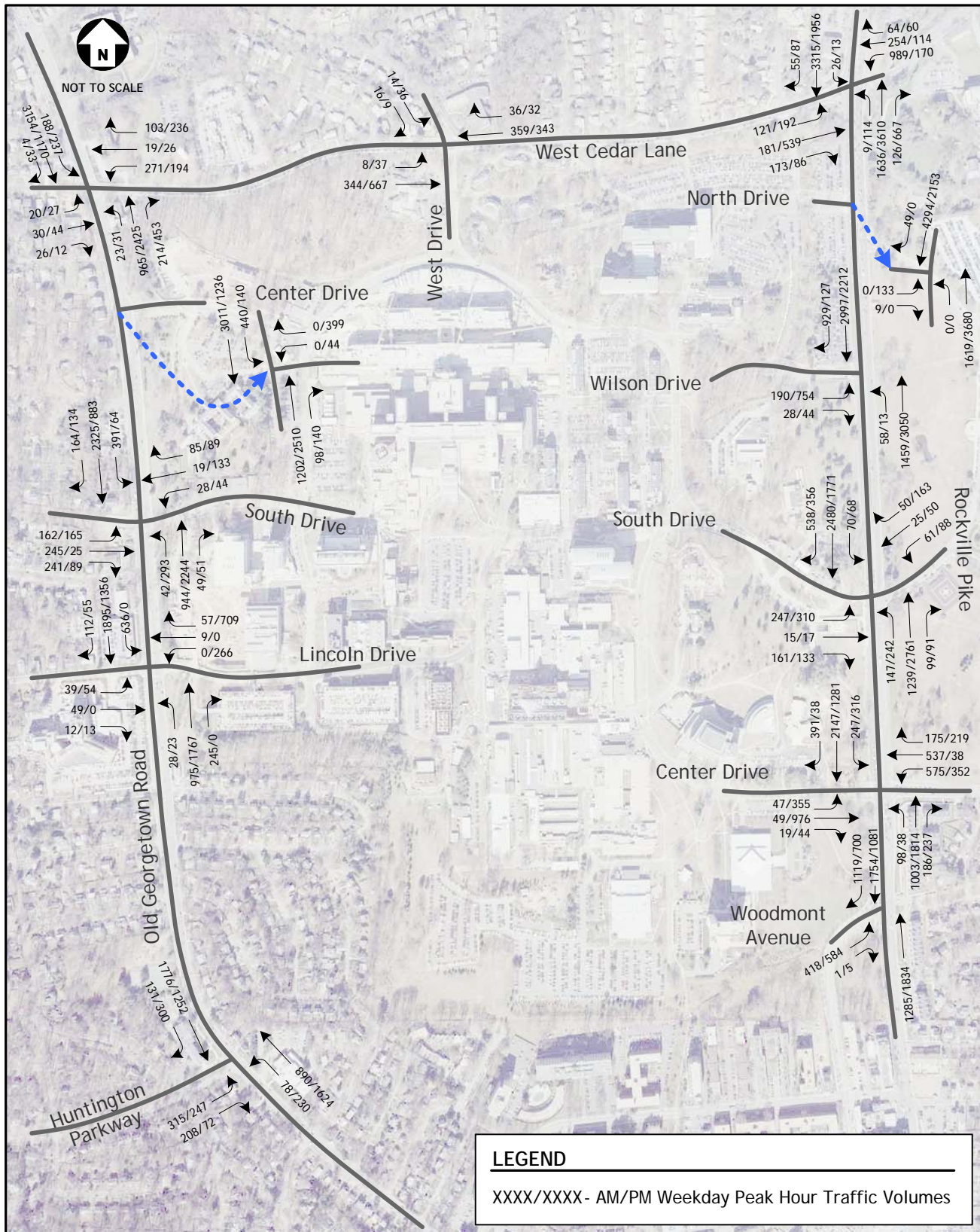


FIGURE G-5 EXISTING WITH MOU PEAK HOUR TRAFFIC VOLUMES.

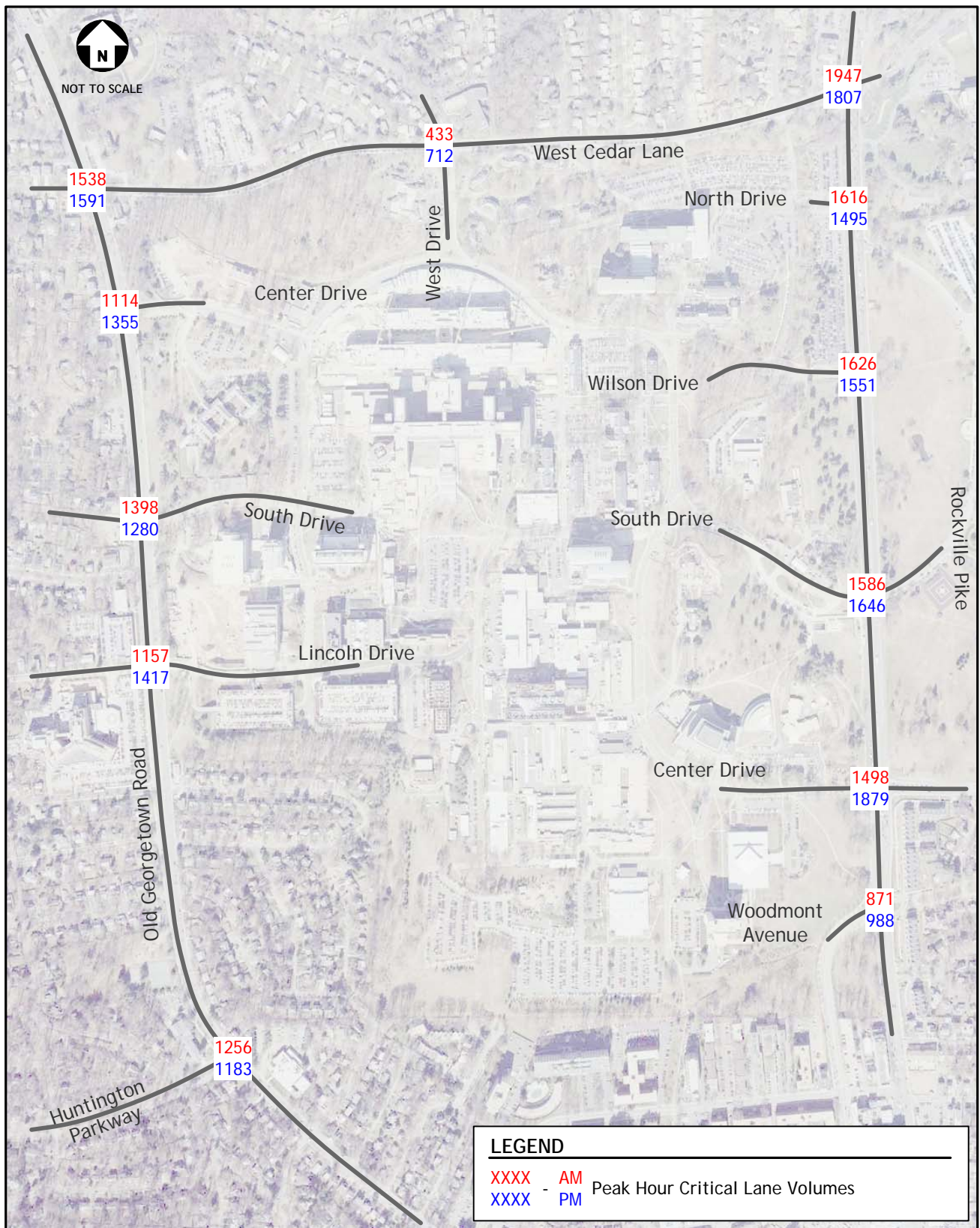


FIGURE G-6 EXISTING WITH MOU AM/PM PEAK HOUR CRITICAL LANE VOLUMES.

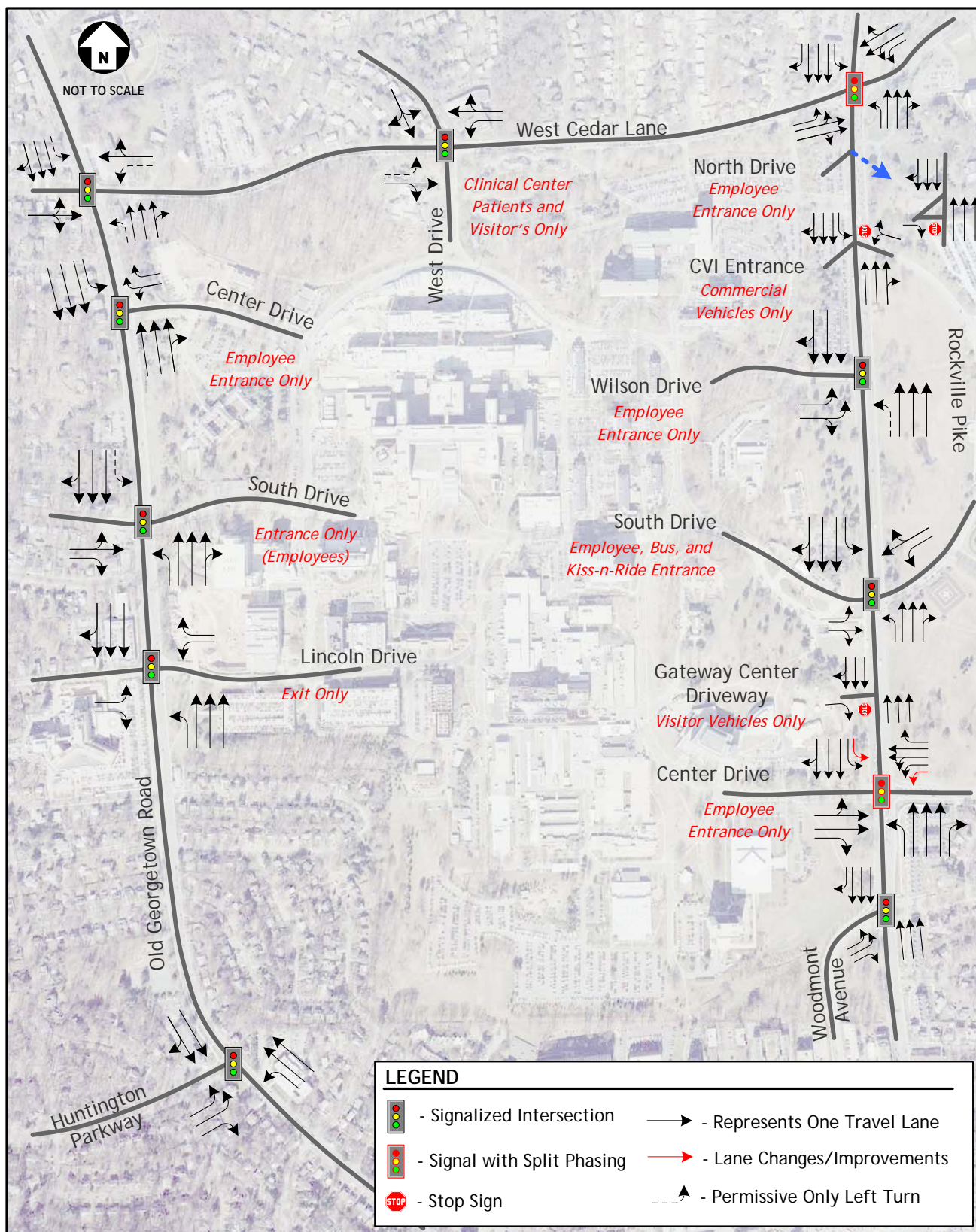


FIGURE G-7 FUTURE LANE CONFIGURATION AND TRAFFIC CONTROL DEVICES.

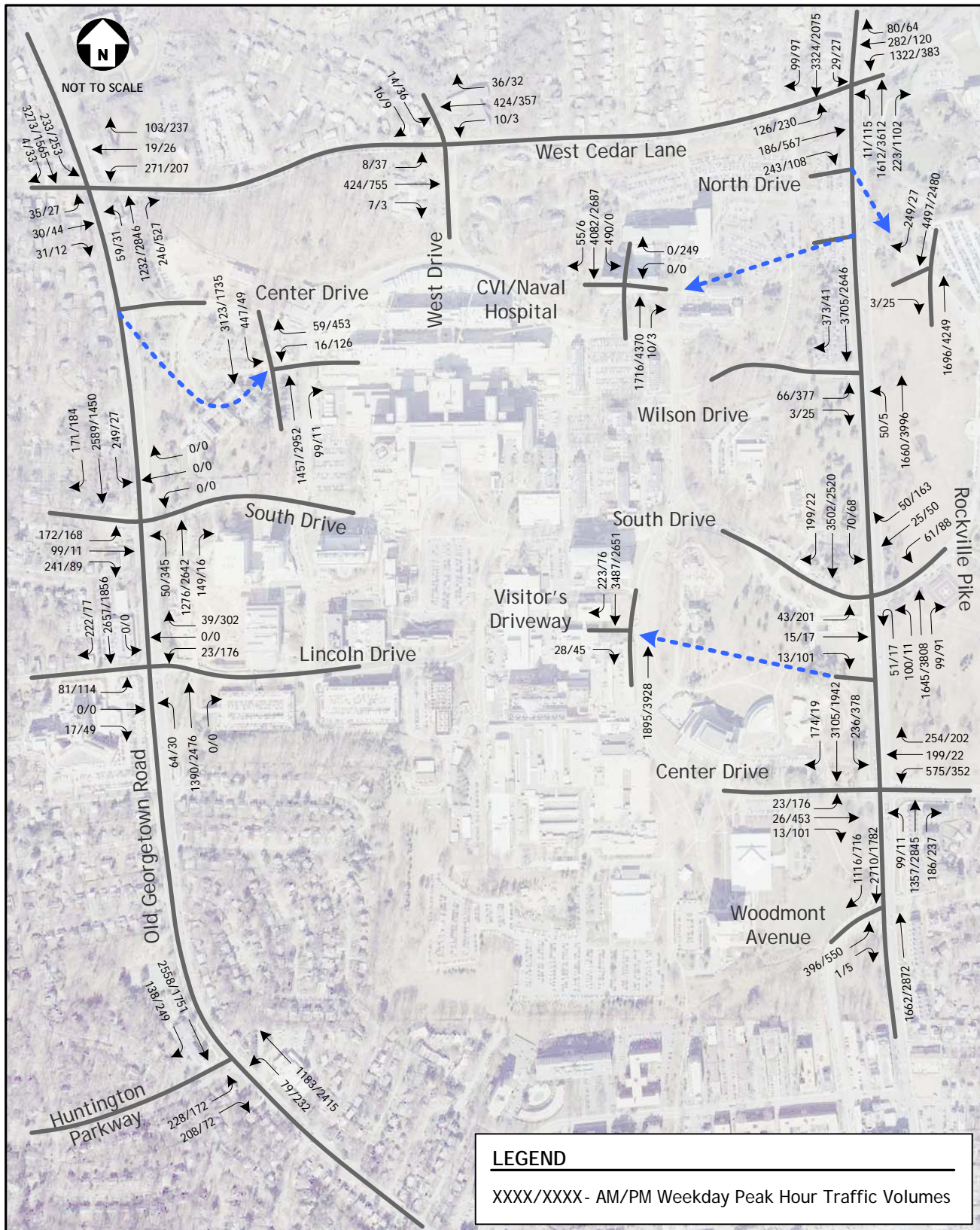


FIGURE G-8 FUTURE NO-ACTION PEAK HOUR TRAFFIC VOLUMES.

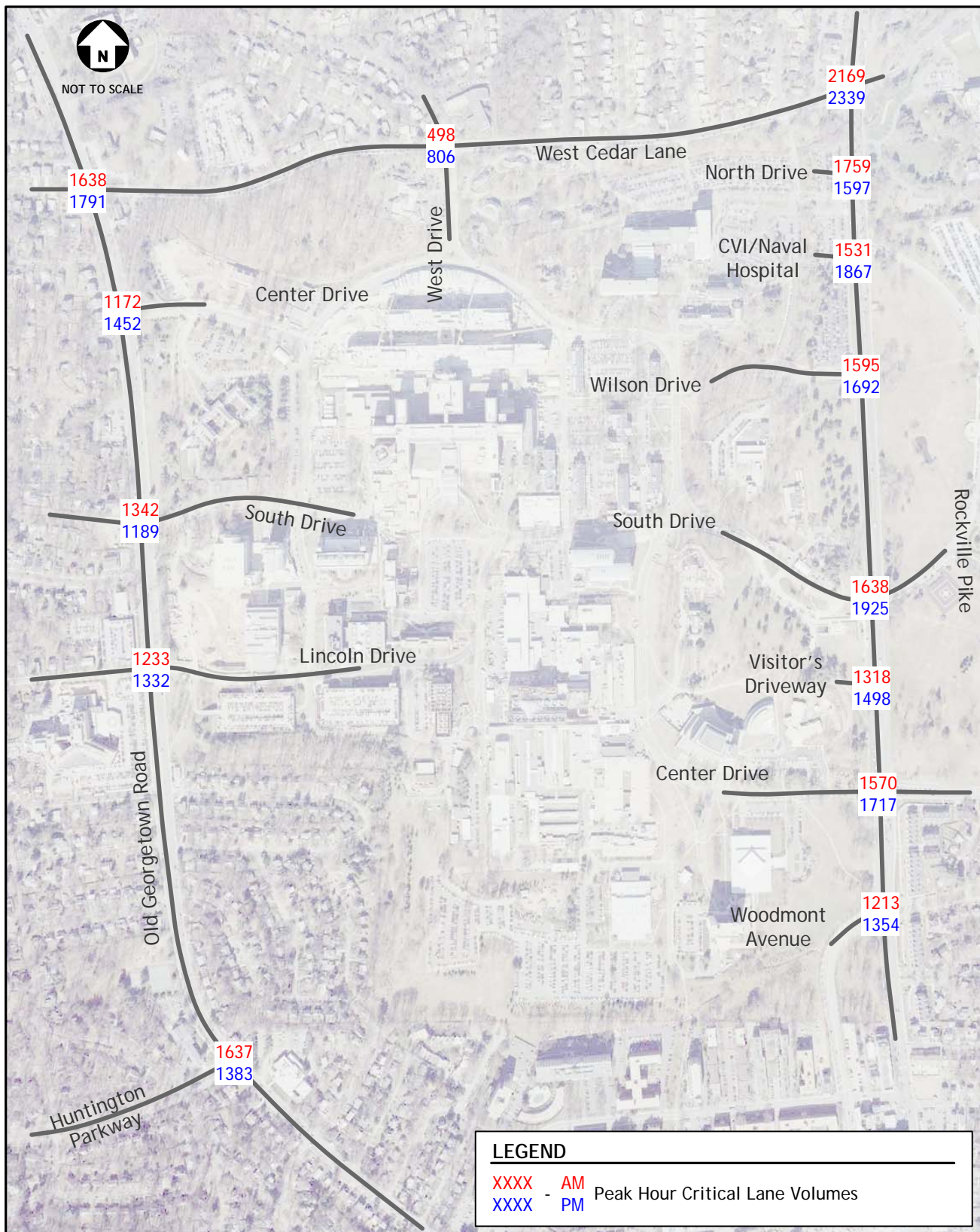


FIGURE G-9 FUTURE NO-ACTION AM/PM PEAK HOUR CRITICAL LANE VOLUMES.

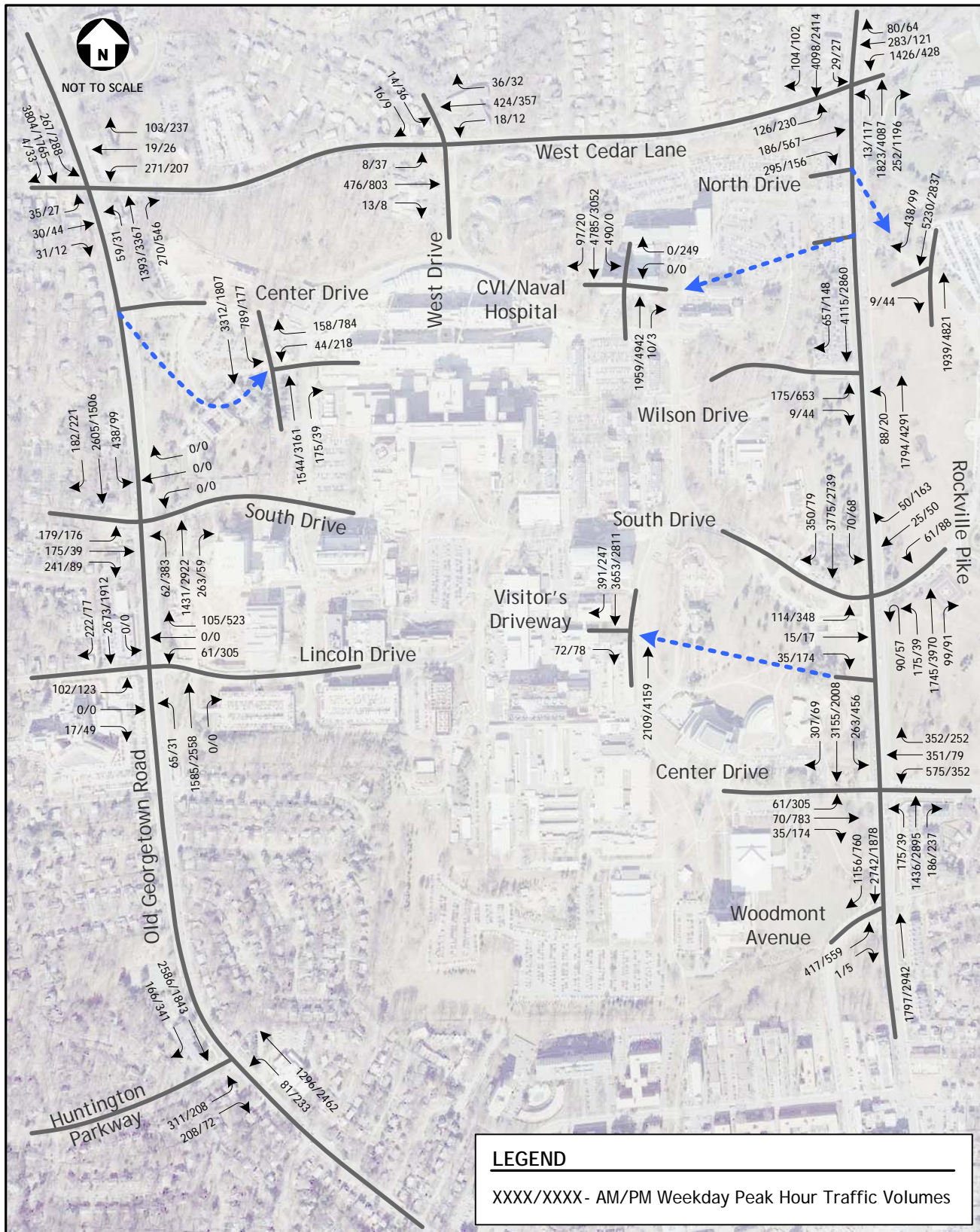


FIGURE G-10 FUTURE WITH MOU PEAK HOUR TRAFFIC VOLUMES.

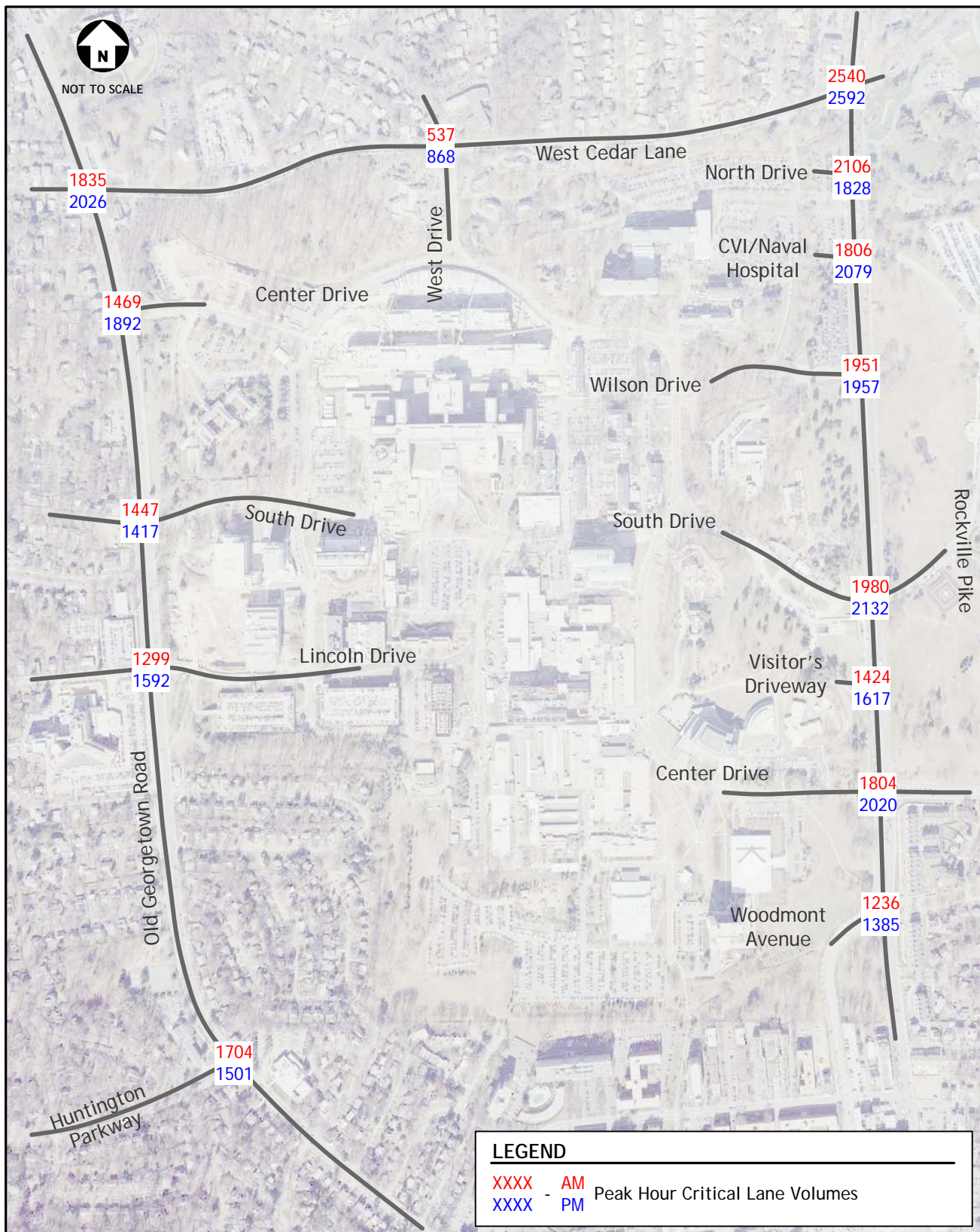


FIGURE G-11 FUTURE WITH MOU AM/PM PEAK HOUR CRITICAL LANE VOLUMES.

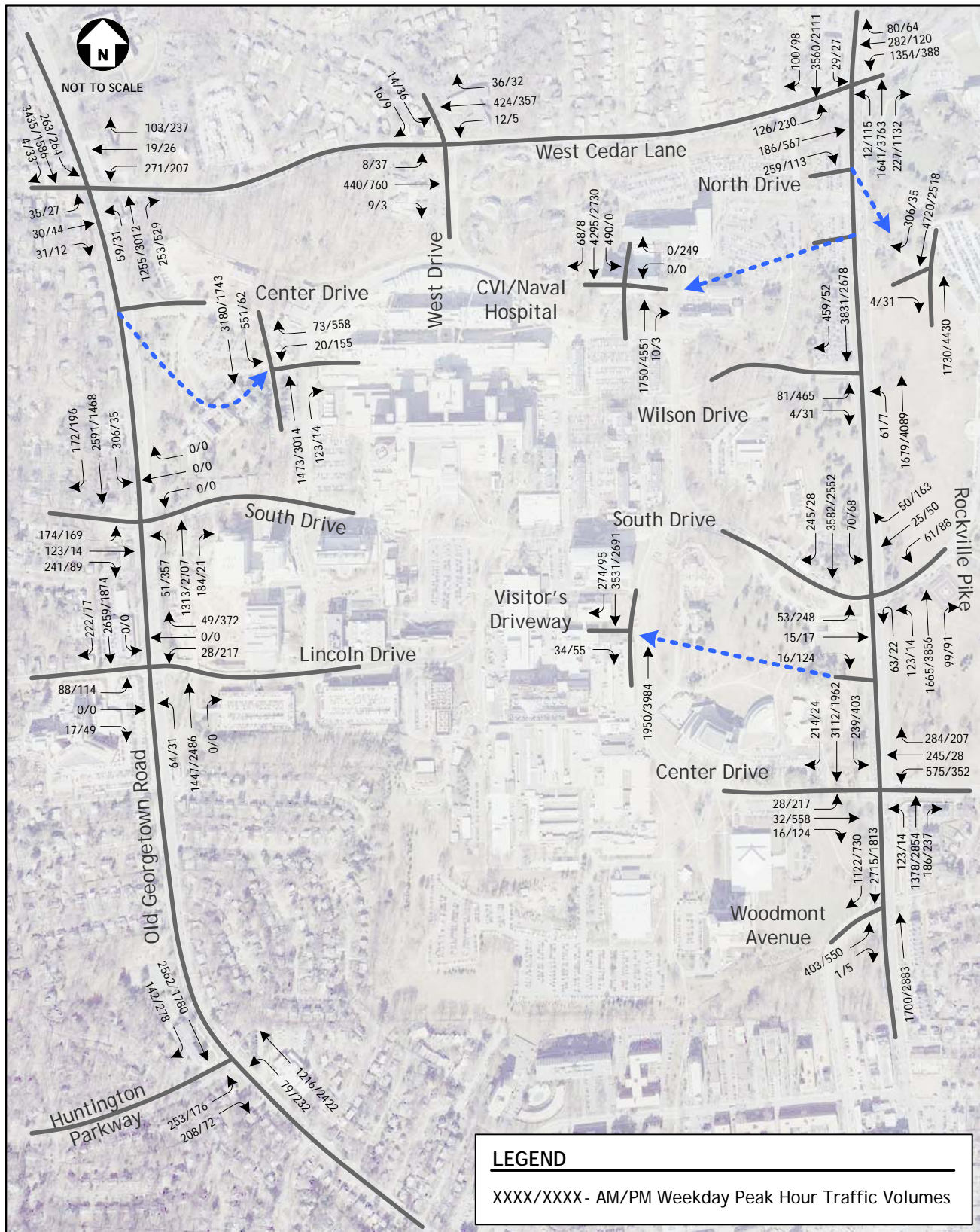


FIGURE G-12 FUTURE WITH MASTER PLAN PEAK HOUR TRAFFIC VOLUMES.

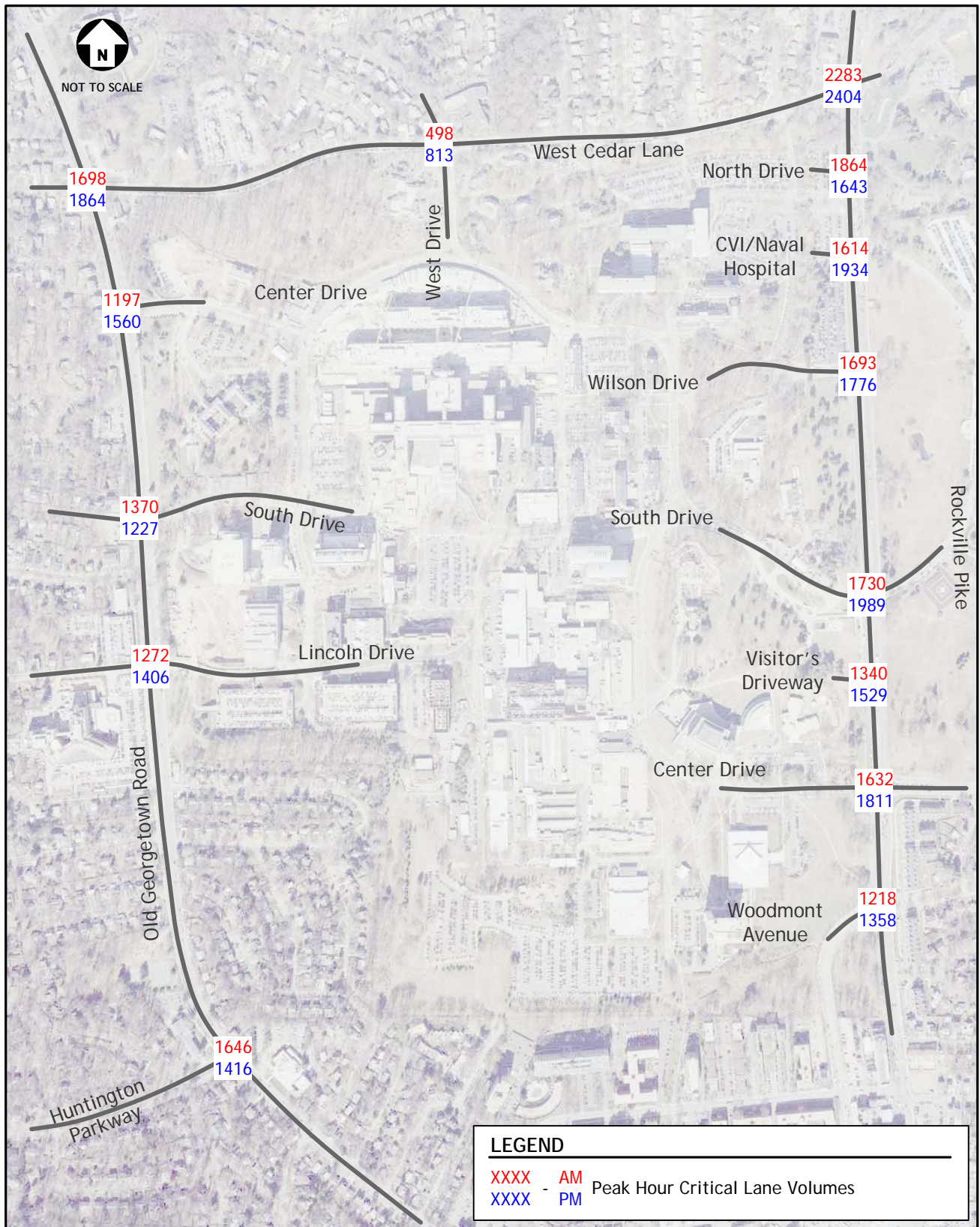


FIGURE G-13 FUTURE WITH MASTER PLAN AM/PM PEAK HOUR CRITICAL LANE VOLUMES.

Intersection	Existing		Existing w/MOU		Future No-Action		Future w/MOU		Future w/Master Plan	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Rockville Pike & Cedar Lane	1614	1793	1947	2054	2169	2339	2540	2592	2283	2404
Rockville Pike & North Drive	1299	1223	1616	1498	1759	1597	2106	1828	1864	1643
Rockville Pike & CVI Entrance	---	---	---	---	1531	1867	1806	2079	1614	1934
Rockville Pike & Wilson Drive	1200	1266	1626	1551	1595	1692	1951	1957	1693	1776
Rockville Pike & South Lane	1218	1446	1586	1646	1638	1925	1980	2132	1730	1989
Rockville Pike & Visitor Driveway	---	---	---	---	1318	1498	1424	1617	1340	1529
Rockville Pike & Center Drive	1230	1480	1498	1879	1570	1717	1804	2020	1632	1811
Rockville Pike & Woodmont Avenue	817	919	871	988	1213	1354	1236	1385	1218	1358
Old Georgetown Road & Cedar Lane	1298	1402	1538	1591	1638	1791	1835	2026	1698	1864
Old Georgetown Road & Center Drive	947	988	1114	1355	1172	1452	1469	1892	1197	1560
Old Georgetown Road & South Drive	1162	998	1398	1280	1342	1189	1447	1417	1370	1227
Old Georgetown Road & Lincoln Drive	820	1065	1157	1417	1233	1332	1299	1592	1272	1406
Old Georgetown Road & Huntington Parkway	1209	1068	1256	1183	1637	1383	1704	1501	1646	1416
Cedar Lane & West Drive	433	712	433	712	498	806	537	868	498	813

TABLE G-1 CRITICAL LANE VOLUME COMPARISON.

Appendix H

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